Semantic Web Technologies RDF Assignment

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Question 1

a. Find all concepts and properties used in the sets,

Command:
arq.bat --data=PeriodicTable.owl --query concepts_and_properties.rq > concepts_and_properties.txt

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX table: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>

SELECT DISTINCT ?concept ?property
WHERE {
  {?s ?p ?o. FILTER(isURI(?o))} UNION
  {?o ?p ?s. FILTER(isURI(?o))}
  BIND (STRAFTER(str(?p), '#') AS ?property)
  BIND (STRAFTER(str(?s), '#') AS ?concept)
}
```

Figure 1. concepts_and_properties.rq query

This query selects all distinct concepts and properties in the dataset.

Output:

concept	property
"Tm"	"period"
"Tm"	"type"
"Tm"	"block"
"Tm"	"standardState"
"Tm"	"classification"
"Tm"	"group"
"Fm"	"period"
"Fm"	"type"
"Fm"	"block"
"Fm"	"standardState"
"Fm"	"classification"
"Fm"	"group"
"Cr"	"period"
"Cr"	"type"
"Cr"	"block"
"Cr"	"standardState"
"Cr"	"classification"
"Cr"	"group"
"group_16"	"element"
"group_16"	"type"
"La"	"period"
"La"	"type"
"La"	"block"
"La"	"standardState"
"La"	"classification"
"La"	"group"
"Lr"	"period"
"Lr"	"type"
"Lr"	"block"

Figure 2. Concepts and properties (concepts_and_properties.txt)

b. Guess the schema of the dataset and represent it graphically. Compare your schema with the one generated by Protégé.

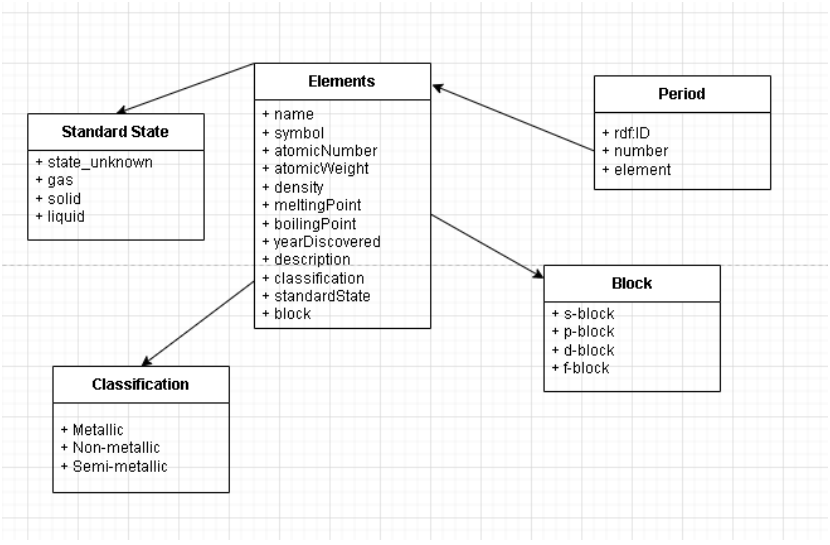


Figure 3. Guessed Schema

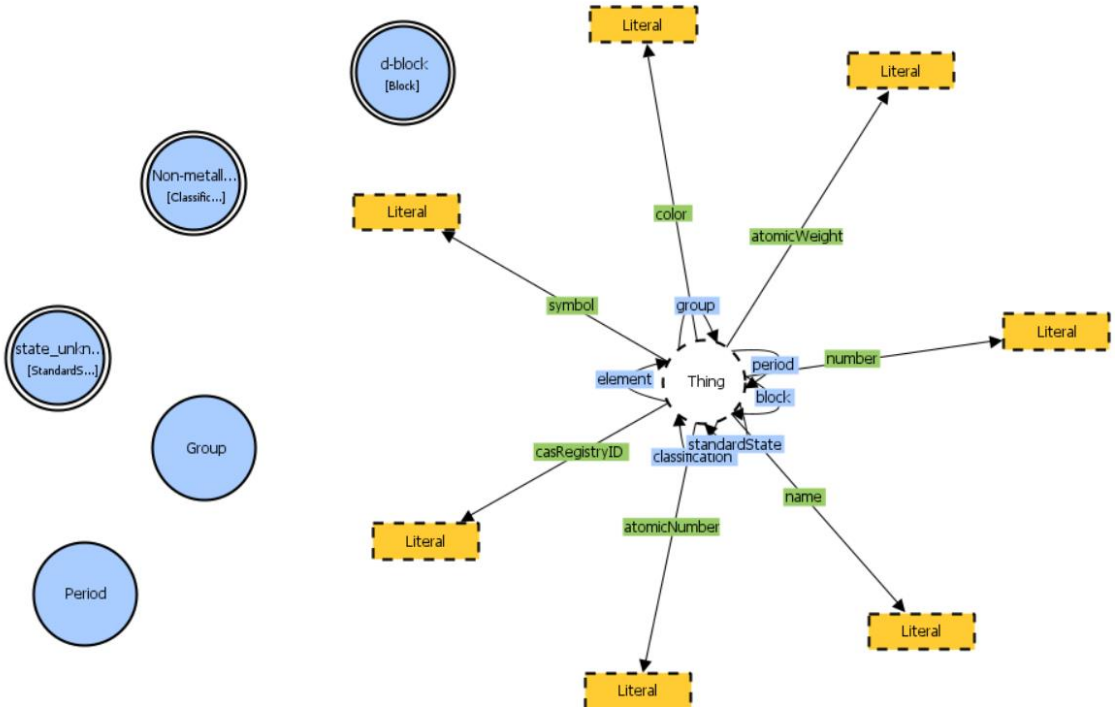


Figure 4. protege vowl schema

I missed a few points such as Group. Also I couldn't specify relations in a correct way as I didn't know.

Question 2

q2.rq is query and q2.txt is result file.

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX perodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>

SELECT ?element
WHERE {
  ?element rdf:type perodicTable:Element .
  ?element perodicTable:standardState perodicTable:liquid .
  ?element perodicTable:classification perodicTable:Metallic .
}
```

Figure 5. q2.rq

```
---------------------
| element           |
=====================
| perodicTable:Hg   |
| perodicTable:Uub  |
---------------------
```

Figure 6. q2.txt

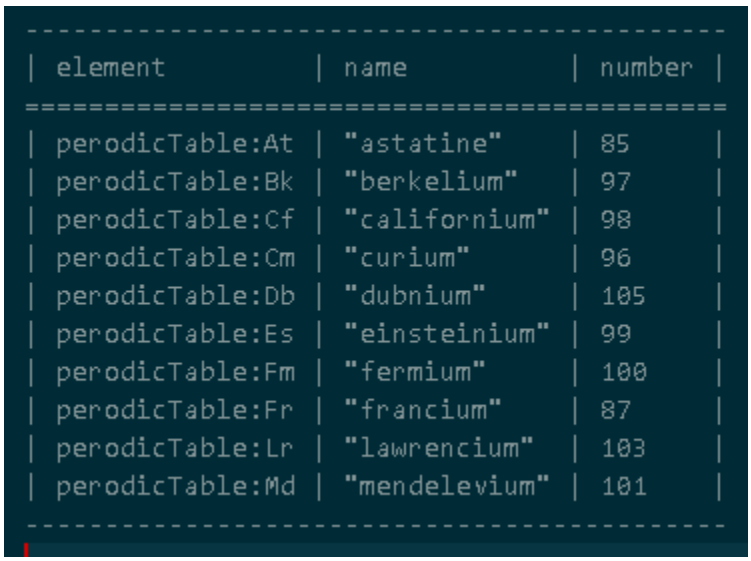
Question 3

q3.rq is query and q3.txt is result file.

```
# Find all elements which atomic number lies between 85 and 105. Limit the dataset to the 10 records starting from the 3rd record. Order the results by name of elements.
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX perodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>

SELECT ?element ?name ?number
WHERE {
  ?element rdf:type perodicTable:Element .
  ?element perodicTable:atomicNumber ?number .
  ?element perodicTable:name ?name .
  FILTER (?number >= 85 && ?number <= 105)
}
ORDER BY ?name
OFFSET 2 LIMIT 10
```

Figure 7.q3.rq



element	name	number
perodicTable:At	"astatine"	85
perodicTable:Bk	"berkelium"	97
perodicTable:Cf	"californium"	98
perodicTable:Cm	"curium"	96
perodicTable:Db	"dubnium"	105
perodicTable:Es	"einsteinium"	99
perodicTable:Fm	"fermium"	100
perodicTable:Fr	"francium"	87
perodicTable:Lr	"lawrencium"	103
perodicTable:Md	"mendelevium"	101

Figure 8. q3.txt

Question 4

q4.rq is query and q4.txt is result file.

```
# Extend the previous query to find whether some not actinides in among the elements.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX periodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>

SELECT ?element ?name ?number
WHERE {
  ?element rdf:type periodicTable:Element .
  ?element periodicTable:atomicNumber ?number .
  ?element periodicTable:name ?name .
  FILTER (?number >= 85 && ?number <= 105)
  FILTER NOT EXISTS { ?element periodicTable:group periodicTable:group_actinoid }
}
ORDER BY ?name
OFFSET 2 LIMIT 10
```

Figure 9.q4.rq

element	name	number
periodicTable:Fr	"francium"	87
periodicTable:Lr	"lawrencium"	103
periodicTable:Ra	"radium"	88
periodicTable:Rn	"radon"	86
periodicTable:Rf	"rutherfordium"	104

Figure 10.q4.txt

Question 5

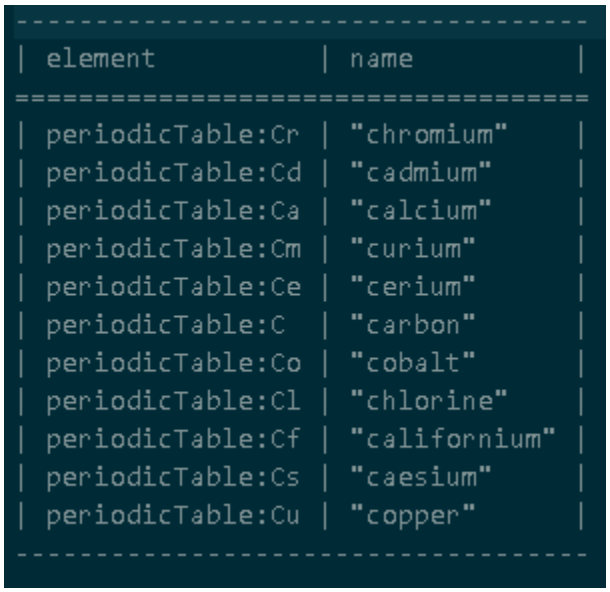
q5.rq is query and q5.txt is result file.

```
# Find all elements which name starts with the letter “C”.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX periodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>

SELECT *
WHERE {
  ?element rdf:type periodicTable:Element .
  ?element periodicTable:name ?name .
  FILTER(STRSTARTS(UCASE(?name), "C"))
}
```

Figure 11.q5.rq



element	name
periodicTable:Cr	"chromium"
periodicTable:Cd	"cadmium"
periodicTable:Ca	"calcium"
periodicTable:Cm	"curium"
periodicTable:Ce	"cerium"
periodicTable:C	"carbon"
periodicTable:Co	"cobalt"
periodicTable:Cl	"chlorine"
periodicTable:Cf	"californium"
periodicTable:Cs	"caesium"
periodicTable:Cu	"copper"

Figure 12.q5.txt

Question 6

q6.rq is query and q6.txt is result file.

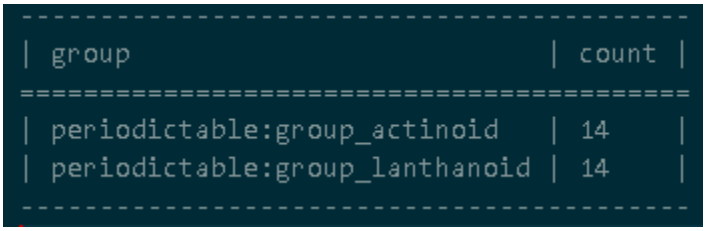
```
# Use the periodic table ontology to determine the number of elements in actinoid and lanthanoid groups.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX periodictable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>

SELECT ?group (COUNT(?element) as ?count)
WHERE {
  ?element rdf:type periodictable:Element ;
           periodictable:group ?group .

  FILTER (?group = periodictable:group_lanthanoid || ?group = periodictable:group_actinoid)
}
GROUP BY ?group
```

Figure 13.q6.rq



group	count
periodictable:group_actinoid	14
periodictable:group_lanthanoid	14

Figure 14.q6.txt

Question 7

q7.rq is query and q7.txt is result file.

```
# Compute the number of neutrons for each element Neutrons=AtomicWeight – AtomicNumber.
The latter corresponds to the number of protons.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX periodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?elementName ?atomicWeight ?atomicNumber ?neutrons
WHERE {
  ?element rdf:type periodicTable:Element ;
           periodicTable:name ?elementName ;
           periodicTable:atomicWeight ?atomicWeight ;
           periodicTable:atomicNumber ?atomicNumber .
  BIND((xsd:float(?atomicWeight) - xsd:float(?atomicNumber)) AS ?neutrons)
}
```

Figure 15.q7.rq

elementName	atomicWeight	atomicNumber	neutrons
"thulium"	"168.93421"^^xsd:float	69	"99.934204"^^xsd:float
"fermium"	"257"^^xsd:float	100	"157.0"^^xsd:float
"chromium"	"51.9961"^^xsd:float	24	"27.996101"^^xsd:float
"lanthanum"	"138.9055"^^xsd:float	57	"81.9055"^^xsd:float
"lawrencium"	"262"^^xsd:float	103	"159.0"^^xsd:float
"seaborgium"	"266"^^xsd:float	106	"160.0"^^xsd:float
"iron"	"55.845"^^xsd:float	26	"29.845001"^^xsd:float
"cadmium"	"112.411"^^xsd:float	48	"64.411"^^xsd:float
"uranium"	"238.02891"^^xsd:float	92	"146.02892"^^xsd:float
"terbium"	"158.92534"^^xsd:float	65	"93.92534"^^xsd:float
"lithium"	"6.941"^^xsd:float	3	"3.941"^^xsd:float
"hydrogen"	"1.00794"^^xsd:float	1	"0.007940054"^^xsd:float
"platinum"	"195.078"^^xsd:float	78	"117.078"^^xsd:float
"dysprosium"	"162.500"^^xsd:float	66	"96.5"^^xsd:float
"calcium"	"40.078"^^xsd:float	20	"20.078"^^xsd:float
"nobelium"	"259"^^xsd:float	102	"157.0"^^xsd:float
"indium"	"114.818"^^xsd:float	49	"65.818"^^xsd:float
"rhodium"	"102.90550"^^xsd:float	45	"57.905502"^^xsd:float
"silver"	"107.8682"^^xsd:float	47	"60.868202"^^xsd:float
"gold"	"196.96655"^^xsd:float	79	"117.96655"^^xsd:float
"sodium"	"22.989770"^^xsd:float	11	"11.989771"^^xsd:float
"actinium"	"227"^^xsd:float	89	"138.0"^^xsd:float

Figure 16. some of q7.txt

Question 8

q8.rq is query and q8.txt is result file.

```
# Find a non-metallic element with the maximum atomic number.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX periodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?elementName ?atomicNumber
WHERE {
  ?element rdf:type periodicTable:Element ;
           periodicTable:name ?elementName ;
           periodicTable:atomicNumber ?atomicNumber ;
           periodicTable:classification periodicTable:Non-metallic .
}
ORDER BY DESC(?atomicNumber)
LIMIT 1
```

Figure 17.q8.rq

```
-------------------------------
| elementName  | atomicNumber |
===============================
| "ununoctium" | 118          |
-------------------------------
```

Figure 18.q8.txt

Question 9

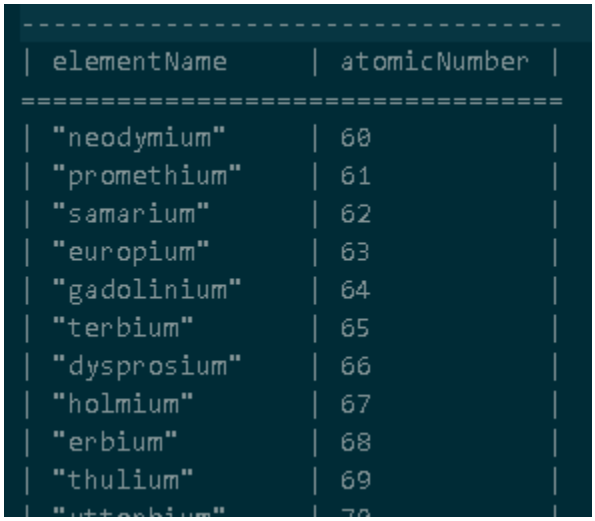
q9.rq is query and q9.txt is result file.

```
# Find all metallic elements which atomic number is greater than the average.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX periodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>

SELECT ?elementName ?atomicNumber
WHERE {
  ?element rdf:type periodicTable:Element ;
           periodicTable:name ?elementName ;
           periodicTable:atomicNumber ?atomicNumber ;
           periodicTable:classification periodicTable:Metallic .
  {
    SELECT (AVG(?atomicNumber) AS ?avgAtomicNumber)
    WHERE {
      ?element rdf:type periodicTable:Element ;
               periodicTable:atomicNumber ?atomicNumber .
    }
  }
  FILTER (?atomicNumber > ?avgAtomicNumber)
}
ORDER BY(?atomicNumber)
```

Figure 19.q9.rq



elementName	atomicNumber
"neodymium"	60
"promethium"	61
"samarium"	62
"europium"	63
"gadolinium"	64
"terbium"	65
"dysprosium"	66
"holmium"	67
"erbium"	68
"thulium"	69

Figure 20.some of q9.txt

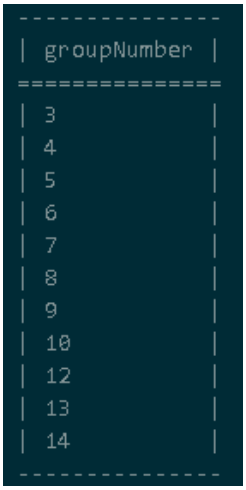
Question 10

q10_1.rq and q10_2.rq are query and q10_1.txt and q10_2.txt are result file.

With using Not Exists

```
PREFIX periodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>
SELECT ?groupNumber
WHERE {
  ?group a periodicTable:Group ;
         periodicTable:number ?groupNumber .
  NOT EXISTS { ?group periodicTable:name ?groupName }
}
ORDER BY ?groupNumber
```

Figure 21.q10_1.rq



groupNumber
3
4
5
6
7
8
9
10
12
13
14

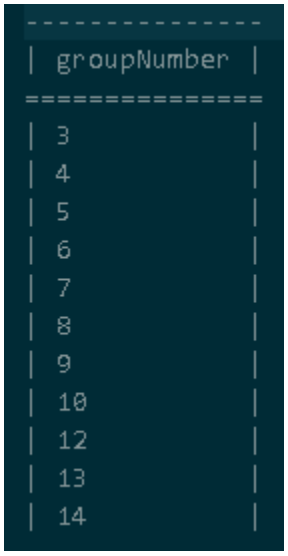
Figure 22.q10_1.txt

With using Filter

```
PREFIX periodicTable: <http://www.daml.org/2003/01/periodictable/PeriodicTable#>

SELECT ?groupNumber
WHERE {
  ?group a periodicTable:Group ;
         periodicTable:number ?groupNumber .
  OPTIONAL { ?group periodicTable:name ?groupName }
  FILTER (!bound(?groupName))
}
ORDER BY ?groupNumber
```

Figure 23.q10_2.rq



groupNumber
3
4
5
6
7
8
9
10
12
13
14

Figure 24. q10_2.txt

Question 11

Couldn't make it