REPORT HOMEWORK 3

Exercise 1

The queries of this exercise are given as follows along with their results:

a.
i)*Find the names and geometries of all municipalities (δήμοι) that are included in a given rectangle.*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>

SELECT ?m ?municipalityName ?geometry
WHERE
{
?m rdf:type gag:Δήμος ;
   gag:έχει_γεωμετρία ?geometry;
   gag:έχει_επίσημο_όνομα ?municipalityName.

FILTER(geof:sfContains("POLYGON((23.148193359375
36.177978515625,23.13720703125 34.43115234375,27.00439453125
34.442138671875,26.993408203125 36.14501953125,23.148193359375
36.177978515625));<http://www.opengis.net/def/crs/EPSG/0/4326>"^^strd
f:WKT,?geometry))
}
```

```
 http://geo.linkedopendata.gr/gag/id/9310        "ΔΗΜΟΣ ΑΓΙΟΥ ΝΙΚΟΛΑΟΥ"
        "MULTIPOLYGON (((661380.1245039892 3887642.999032771,
661369.8745039967 3887642.9990327815, 661364....   more
http://geo.linkedopendata.gr/gag/id/9311        "ΔΗΜΟΣ ΙΕΡΑΠΕΤΡΑΣ"
        "MULTIPOLYGON (((659150.3120338336 3860567.999090977,
659153.9995338372 3860562.9990909835, 659155....   more
http://geo.linkedopendata.gr/gag/id/9305        "ΔΗΜΟΣ ΗΡΑΚΛΕΙΟΥ"
        "MULTIPOLYGON (((602945.1870098887 3911413.9990462647,
602942.8745099042 3911398.9990462977, 602958...   more
http://geo.linkedopendata.gr/gag/id/9304        "ΔΗΜΟΣ ΓΟΡΤΥΝΑΣ"
        "MULTIPOLYGON (((586233.6245383659 3893030.999101944,
586325.8745384172 3892936.99910204, 586585.31...   more
```

http://geo.linkedopendata.gr/gag/id/9303 "ΔΗΜΟΣ ΒΙΑΝΝΟΥ" "MULTIPOLYGON (((639429.8745274253 3876496.9990792414, 639574.6245271652 3876669.9990787283, 639655... more
http://geo.linkedopendata.gr/gag/id/9306 "ΔΗΜΟΣ ΜΑΛΕΒΙΖΙΟΥ" "MULTIPOLYGON (((588252.1245084775 3920158.999043931, 588291.4995084648 3920151.9990439056, 588324.... more
http://geo.linkedopendata.gr/gag/id/9302 "ΔΗΜΟΣ ΑΡΧΑΝΩΝ - ΑΣΤΕΡΟΥΣΙΩΝ" "MULTIPOLYGON (((607430.3120154765 3903882.9990569865, 607588.6245154208 3903854.9990568752, 607688... more
http://geo.linkedopendata.gr/gag/id/9307 "ΔΗΜΟΣ ΜΙΝΩΑ ΠΕΔΙΑΔΑΣ" "MULTIPOLYGON (((620826.812009781 3902499.9990455415, 621107.1870099055 3902241.9990457715, 621329.... more
http://geo.linkedopendata.gr/gag/id/9313 "ΔΗΜΟΣ ΣΗΤΕΙΑΣ" "MULTIPOLYGON (((694676.3120093178 3866178.999041172, 694696.6245093148 3866170.999041166, 694700.4... more
http://geo.linkedopendata.gr/gag/id/9312 "ΔΗΜΟΣ ΟΡΟΠΕΔΙΟΥ ΛΑΣΙΘΙΟΥ" "MULTIPOLYGON (((628636.3120177335 3891067.999060746, 628454.3745178794 3891021.9990610373, 628290.... more
http://geo.linkedopendata.gr/gag/id/9309 "ΔΗΜΟΣ ΧΕΡΣΟΝΗΣΟΥ" "MULTIPOLYGON (((624971.6244983075 3911238.9990231227, 625026.811998309 3911209.9990231255, 625065.... more
http://geo.linkedopendata.gr/gag/id/9308 "ΔΗΜΟΣ ΦΑΙΣΤΟΥ" "MULTIPOLYGON (((571527.6245771191 3864022.9991774373, 571514.8745771238 3864022.99917745, 571509.8... more
http://geo.linkedopendata.gr/gag/id/9322 "ΔΗΜΟΣ ΚΙΣΣΑΜΟΥ" "MULTIPOLYGON (((457703.4995971886 3902962.999218486, 457703.31209721067 3902942.999218529, 457703.... more
http://geo.linkedopendata.gr/gag/id/9320 "ΔΗΜΟΣ ΓΑΥΔΟΥ" "MULTIPOLYGON (((499442.8121140515 3865956.9992503105, 499444.09336405253 3865955.999250313, 499451... more
http://geo.linkedopendata.gr/gag/id/9316 "ΔΗΜΟΣ ΑΝΩΓΕΙΩΝ" "MULTIPOLYGON (((576294.4995268006 3908947.9990797546, 576666.4995265163 3909028.9990791935, 576789... more
http://geo.linkedopendata.gr/gag/id/9314 "ΔΗΜΟΣ ΑΓΙΟΥ ΒΑΣΙΛΕΙΟΥ" "MULTIPOLYGON (((553709.8745761677 3873959.999175937, 553727.8120761572 3873958.9991759206, 553734.... more
http://geo.linkedopendata.gr/gag/id/9317 "ΔΗΜΟΣ ΜΥΛΟΠΟΤΑΜΟΥ" "MULTIPOLYGON (((584060.9995124436 3918541.9990517274, 584052.1245124495 3918540.999051738, 584029.... more
http://geo.linkedopendata.gr/gag/id/9321 "ΔΗΜΟΣ ΚΑΝΤΑΝΟΥ - ΣΕΛΙΝΟΥ" "MULTIPOLYGON (((469969.81209655 3897334.9992170134, 469955.68709656346 3897328.9992170394, 469950.... more
http://geo.linkedopendata.gr/gag/id/9323 "ΔΗΜΟΣ ΠΛΑΤΑΝΙΑ" "MULTIPOLYGON (((476162.81203735736 3949683.9991026204, 476195.68703734776 3949674.9991026046, 4762... more

http://geo.linkedopendata.gr/gag/id/9318 "ΔΗΜΟΣ ΡΕΘΥΜΝΗΣ"
"MULTIPOLYGON (((558287.9995260253 3918784.9990786933,
558369.1870262237 3918557.999079076, 558417.... more
http://geo.linkedopendata.gr/gag/id/9324 "ΔΗΜΟΣ ΣΦΑΚΙΩΝ"
"MULTIPOLYGON (((516082.6870742956 3894806.999173069,
516070.9995743077 3894801.9991730917, 516030.... more
http://geo.linkedopendata.gr/gag/id/9319 "ΔΗΜΟΣ ΑΠΟΚΟΡΩΝΟΥ"
"MULTIPOLYGON (((517411.0932931896 3923337.9991128813,
517421.3120431923 3923332.9991128813, 517433... more
http://geo.linkedopendata.gr/gag/id/9315 "ΔΗΜΟΣ ΑΜΑΡΙΟΥ"
"MULTIPOLYGON (((553568.9995428469 3905352.9991113823,
553629.1245428282 3905339.9991113422, 553687... more
http://geo.linkedopendata.gr/gag/id/9325 "ΔΗΜΟΣ ΧΑΝΙΩΝ"
"MULTIPOLYGON (((513756.9995413921 3926875.9991094936,
513737.4057914316 3926849.9991095676, 513725... more

ii) Display on a map the geometries of all municipalities of the regional unit of Heraklion (Περιφερειακή ενότητα Ηρακλείου).

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>

SELECT ?municipalityName ?minicipalityGeo
WHERE
{
?m a gag:Δήμος ;
  gag:έχει_επίσημο_όνομα ?municipalityName ;
  gag:έχει_γεωμετρία ?municipalityGeo;
  gag:ανήκει_σε ?ru .

?ru a gag:Περιφερειακή_Ενότητα;
  gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑΚΗ ΕΝΟΤΗΤΑ ΗΡΑΚΛΕΙΟΥ" .
}
```

iii) Find the names of all municipalities of the regional unit of Heraklion (Περιφερειακή ενότητα Ηρακλείου) that have geometries disjoint from the geometry of the municipality of Hersonissos (Δήμος Χερσονήσου).

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
```

```
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>

SELECT  ?municipalityName
WHERE
{
?ru a gag:Περιφερειακή_Ενότητα;
      gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑΚΗ ΕΝΟΤΗΤΑ ΗΡΑΚΛΕΙΟΥ"
.

?m a gag:Δήμος ;
   gag:έχει_επίσημο_όνομα ?municipalityName ;
   gag:έχει_γεωμετρία ?municipalityGeo;
   gag:ανήκει_σε ?ru .

?cher a gag:Δήμος ;
    gag:έχει_επίσημο_όνομα "ΔΗΜΟΣ ΧΕΡΣΟΝΗΣΟΥ" ;
    gag:έχει_γεωμετρία ?chersonisosGeo.

FILTER(geof:sfDisjoint(?municipalityGeo, ?chersonisosGeo))
}
```

iv) Compute the total area of all municipalities of the region of Crete.

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>

SELECT (strdf:area(strdf:union(?municipalityGeo)) as ?creteArea)
WHERE
{
?m rdf:type gag:Δήμος ;
   gag:έχει_επίσημο_όνομα ?municipalityName ;
   gag:έχει_γεωμετρία ?municipalityGeo;
   gag:ανήκει_σε/gag:ανήκει_σε ?region .

?region a gag:Περιφέρεια;
   gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΚΡΗΤΗΣ" .
}
```

creteArea
"8.341491056931825E9"^^http://www.w3.org/2001XMLSchema#double

b.

i)*Find all the rivers and lakes and show the results on a map.*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>

SELECT  ?waterbodyName  ?waterbodyWKT
WHERE
{
?waterbody  geowb:είναι_το_υδάτινο_σώμα ?wb.
?wb  geowb:έχει_όνομα ?waterbodyName;
     geo:hasGeometry ?waterbodyGeo.
?waterbodyGeo geo:asWKT ?waterbodyWKT.
}
```

ii)*Find the five biggest rivers of Greece and show them on a map.*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>

SELECT ?river ?riverName  ?riverGeoWKT
WHERE
{
?river a geowb:Ποτάμι ;
      geowb:έχει_μήκος ?length ;
      geowb:είναι_το_υδάτινο_σώμα ?wb.
?wb    geowb:έχει_όνομα ?riverName ;
         geo:hasGeometry ?riverGeo.
?riverGeo geo:asWKT ?riverGeoWKT.

}ORDER BY DESC(?length)
LIMIT 5
```

iii)*Find all the lakes and rivers which intersect each other and display them on a map.*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>

SELECT ?riverName ?lakeName ?lakeGeoWKT ?riverGeoWKT
WHERE
{
?lake a geowb:Λίμνη ;
     geowb:είναι_το_υδάτινο_σώμα ?wb1.
?wb1  geowb:έχει_όνομα ?lakeName;
     geo:hasGeometry ?lakeGeo.
?lakeGeo geo:asWKT ?lakeGeoWKT.

?river a geowb:Ποτάμι;
      geowb:είναι_το_υδάτινο_σώμα ?wb2.
?wb2   geowb:έχει_όνομα ?riverName;
      geo:hasGeometry ?riverGeo.
?riverGeo geo:asWKT ?riverGeoWKT.

FILTER(strdf:intersects(strdf:transform(?lakeGeoWKT,
epsg:4326),strdf:transform(?riverGeoWKT, epsg:4326)))   }
```

c.

i)*Find all the municipalities that are crossed by a river.*

```
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>

SELECT  ?municipalityName ?municipalityGeo
WHERE
{
?m rdf:type gag:Δήμος ;
   gag:έχει_επίσημο_όνομα ?municipalityName ;
   gag:έχει_γεωμετρία ?municipalityGeo.

?river a geowb:Ποτάμι ;
     geowb:είναι_το_υδάτινο_σώμα ?b.
?b geowb:έχει_όνομα ?riverName;
     geo:hasGeometry ?riverGeo.
?riverGeo geo:asWKT ?riverWKT.

FILTER(strdf:crosses(strdf:transform(?riverWKT,
epsg:4326),strdf:buffer(?municipalityGeo, 0, uom:metre)))
}
```

ii)*Find all the municipalities that intersect with a lake.*

```
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>

SELECT  ?municipalityName ?municipalityGeo
WHERE
{
?lake a geowb:Λίμνη ;
```

```
      geowb:είναι_το_υδάτινο_σώμα ?wb1.
?wb1  geowb:έχει_όνομα ?lakeName;
      geo:hasGeometry ?lakeGeo.
?lakeGeo geo:asWKT ?lakeGeoWKT.

?m rdf:type gag:Δήμος ;
  gag:έχει_επίσημο_όνομα ?municipalityName ;
  gag:έχει_γεωμετρία ?municipalityGeo.

FILTER(strdf:intersects(strdf:transform(?lakeGeoWKT,
epsg:4326),strdf:buffer(?municipalityGeo, 0, uom:metre)))
}
```

iii)*Find all the rivers that cross through at least two municipalities.*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>

SELECT  ?riverName ?riverWKT
WHERE
{
?m1 rdf:type gag:Δήμος ;
  gag:έχει_γεωμετρία ?municipalityGeo1.

?m2 rdf:type gag:Δήμος ;
  gag:έχει_γεωμετρία ?municipalityGeo2.

?river a geowb:Ποτάμι ;
    geowb:είναι_το_υδάτινο_σώμα ?wb.
?wb geowb:έχει_όνομα ?riverName;
    geo:hasGeometry ?riverGeo.
?riverGeo geo:asWKT ?riverWKT.

FILTER(
(strdf:crosses(strdf:transform(?riverWKT,epsg:4326),strdf:buffer(?municip
alityGeo1 ,0, uom:metre))) &&
(strdf:crosses(strdf:transform(?riverWKT,epsg:4326),strdf:buffer(?municip
alityGeo2 , 0, uom:metre))) && (?m1 != ?m2) )
}
```

iv)*Find all the rivers in the region of Crete (ΠΕΡΙΦΕΡΕΙΑ ΚΡΗΤΗΣ).*

```
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX wb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>

SELECT ?riverName ?riverWKT
WHERE
{
?p a gag:Περιφέρεια;
   gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΚΡΗΤΗΣ";
   gag:έχει_γεωμετρία ?regionGeo.

?river a geowb:Ποτάμι ;
    geowb:είναι_το_υδάτινο_σώμα ?wb.
?wb geowb:έχει_όνομα ?riverName;
    geo:hasGeometry ?riverGeo.
?riverGeo geo:asWKT ?riverWKT.

FILTER(strdf:within(strdf:transform(?riverWKT,
epsg:4326),strdf:buffer(?regionGeo, 0, uom:metre)))
}
```

vi)*Find all the lakes in the region of Western Greece (ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΕΛΛΑΔΑΣ).*

```
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>

SELECT  ?lakeName ?lakeWKT
WHERE
{
?lake a geowb:Λίμνη ;
```

```
  geowb:είναι_το_υδάτινο_σώμα ?wb.
?wb geowb:έχει_όνομα ?lakeName;
   geo:hasGeometry ?lakeGeo.
?lakeGeo geo:asWKT ?lakeWKT.

?region a gag:Περιφέρεια;
   gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΕΛΛΑΔΑΣ";
   gag:έχει_γεωμετρία ?regionGeo.

FILTER(strdf:intersects(strdf:transform(?lakeWKT,
epsg:4326),strdf:buffer(?regionGeo, 0, uom:metre)))
}
```

v)*Find all the rivers in the region of Crete that are entirely contained in a single municipality of Crete.*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>

SELECT  ?riverName ?municipalityName
WHERE
{
?region a gag:Περιφέρεια;
   gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΚΡΗΤΗΣ".

?m rdf:type gag:Δήμος ;
   gag:ανήκει_σε/gag:ανήκει_σε ?region;
   gag:έχει_επίσημο_όνομα ?municipalityName ;
   gag:έχει_γεωμετρία ?municipalityGeo .

?river a geowb:Ποτάμι ;
    geowb:είναι_το_υδάτινο_σώμα ?wb.
?wb geowb:έχει_όνομα ?riverName;
    geo:hasGeometry ?riverGeo.
?riverGeo geo:asWKT ?riverWKT.

FILTER(geof:sfWithin(?riverWKT,?municipalityGeo))
}
```

riverName	municipalityName
ΤΑΥΡΩΝΙΤΗΣ Π.	ΔΗΜΟΣ ΠΛΑΤΑΝΙΑ
ΝΤΕΡΙΑΝΟΣ Ρ.	ΔΗΜΟΣ ΠΛΑΤΑΝΙΑ
ΝΤΕΡΙΑΝΟΣ Ρ.	ΔΗΜΟΣ ΠΛΑΤΑΝΙΑ
ΤΑΥΡΩΝΙΤΗΣ Π.	ΔΗΜΟΣ ΠΛΑΤΑΝΙΑ
ΠΕΛΕΚΑΝΙΩΤΙΚΟΣ Π.	ΔΗΜΟΣ ΚΑΝΤΑΝΟΥ - ΣΕΛΙΝΟΥ
UNK 2	ΔΗΜΟΣ ΚΙΣΣΑΜΟΥ
UNK 2	ΔΗΜΟΣ ΚΙΣΣΑΜΟΥ
ΤΣΙΧΛΙΑΝΟ ΦΑΡΑΓΓΙ	ΔΗΜΟΣ ΚΙΣΣΑΜΟΥ
ΤΣΙΧΛΙΑΝΟ ΦΑΡΑΓΓΙ	ΔΗΜΟΣ ΚΙΣΣΑΜΟΥ
ΜΟΥΣΕΛΑΣ Π.	ΔΗΜΟΣ ΑΠΟΚΟΡΩΝΟΥ
ΑΛΜΥΡΟΣ Π.	ΔΗΜΟΣ ΑΠΟΚΟΡΩΝΟΥ
ΚΟΥΤΣΟΥΛΙΔΗ Ρ.	ΔΗΜΟΣ ΦΑΙΣΤΟΥ
ΓΕΡΩ - ΠΟΤΑΜΟΣ	ΔΗΜΟΣ ΦΑΙΣΤΟΥ
ΓΙΟΦΥΡΟΣ Ρ.	ΔΗΜΟΣ ΗΡΑΚΛΕΙΟΥ
ΓΑΖΑΝΟΣ Ρ.	ΔΗΜΟΣ ΜΑΛΕΒΙΖΙΟΥ
ΠΕΝΤΕΛΗΣ Ρ.	ΔΗΜΟΣ ΣΗΤΕΙΑΣ
ΜΥΡΤΟΣ Π.	ΔΗΜΟΣ ΙΕΡΑΠΕΤΡΑΣ
ΜΥΡΤΟΣ Π.	ΔΗΜΟΣ ΙΕΡΑΠΕΤΡΑΣ
ΚΑΛΑΜΑΥΚΙΑΝΟΣ Ρ.	ΔΗΜΟΣ ΙΕΡΑΠΕΤΡΑΣ
ΚΟΡΑΚΟΥ Ρ.	ΔΗΜΟΣ ΙΕΡΑΠΕΤΡΑΣ
UNK 1	ΔΗΜΟΣ ΙΕΡΑΠΕΤΡΑΣ
ΚΑΜΙΝΙΑ Ρ.	ΔΗΜΟΣ ΡΕΘΥΜΝΗΣ
ΚΙΣΣΑΝΟ ΦΑΡΑΓΓΙ	ΔΗΜΟΣ ΑΓΙΟΥ ΒΑΣΙΛΕΙΟΥ
ΠΛΑΤΥΣ Π.	ΔΗΜΟΣ ΑΜΑΡΙΟΥ

vi)*Find all the lakes in the region of Western Greece (ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΕΛΛΑΔΑΣ).*

```
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>

SELECT  ?lakeName
WHERE
```

```
        {
        ?region a gag:Περιφέρεια;
           gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΕΛΛΑΔΑΣ";
           gag:έχει_γεωμετρία ?regionGeo.

        ?lake a geowb:Λίμνη ;
          geowb:είναι_το_υδάτινο_σώμα ?wb.
        ?wb geowb:έχει_όνομα ?lakeName;
           geo:hasGeometry ?lakeGeo.
        ?lakeGeo geo:asWKT ?lakeWKT.

        FILTER(strdf:intersects(strdf:transform(?lakeWKT,
        epsg:4326),strdf:buffer(?regionGeo, 0, uom:metre)))
}
```

lakeName
ΛΙΜΝΗ ΣΑΛΤΙΝΗ
ΛΙΜΝΗ ΒΟΥΛΚΑΡΙΑ
ΛΙΜΝΗ ΑΜΒΡΑΚΙΑ
ΛΙΜΝΗ ΤΡΙΧΩΝΙΔΑ
ΤΕΧΝΗΤΗ ΛΙΜΝΗ ΕΥΗΝΟΥ
ΛΙΜΝΗ ΟΖΕΡΟΣ
ΛΙΜΝΗ ΛΥΣΙΜΑΧΕΙΑ
ΤΕΧΝΗΤΗ ΛΙΜΝΗ ΚΑΣΤΡΑΚΙΟΥ
ΤΕΧΝΗΤΗ ΛΙΜΝΗ ΚΡΕΜΑΣΤΩΝ
ΤΕΧΝΗΤΗ ΛΙΜΝΗ ΣΤΡΑΤΟΥ
ΤΕΧΝΗΤΗ ΛΙΜΝΗ ΠΗΝΕΙΟΥ
ΛΙΜΝΗ ΛΑΜΙΑ

vii)*Find the ten bigger lakes of Greece and the regions they belong to.*

```
        PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
        PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
        PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
        PREFIX geo: <http://www.opengis.net/ont/geosparql#>
        PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
        PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
        PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
        PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
        PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>

        SELECT  ?lakeName ?regionName
        WHERE
```

```
{
?r a gag:Περιφέρεια;
   gag:έχει_επίσημο_όνομα ?regionName;
   gag:έχει_γεωμετρία ?regionGeo.

?lake a geowb:Λίμνη ;
   geowb:έχει_εμβαδόν ?area;
  geowb:είναι_το_υδάτινο_σώμα ?wb.
?wb geowb:έχει_όνομα ?lakeName;
   geo:hasGeometry ?lakeGeo.
?lakeGeo geo:asWKT ?lakeWKT.

FILTER(strdf:intersects(strdf:transform(?lakeWKT,
epsg:4326),strdf:buffer(?regionGeo, 0, uom:metre)))
}ORDER BY DESC(?area)
LIMIT 10
```

lakeName	regionName
ΛΙΜΝΗ ΜΕΓΑΛΗ ΠΡΕΣΠΑ	ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ
ΛΙΜΝΗ ΤΡΙΧΩΝΙΔΑ	ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΕΛΛΑΔΑΣ
ΛΙΜΝΗ ΒΟΛΒΗ	ΠΕΡΙΦΕΡΕΙΑ ΚΕΝΤΡΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ
ΤΕΧΝΗΤΗ ΛΙΜΝΗ ΚΡΕΜΑΣΤΩΝ	ΠΕΡΙΦΕΡΕΙΑ ΣΤΕΡΕΑΣ ΕΛΛΑΔΑΣ
ΤΕΧΝΗΤΗ ΛΙΜΝΗ ΚΡΕΜΑΣΤΩΝ	ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΕΛΛΑΔΑΣ
ΤΕΧΝΗΤΗ ΛΙΜΝΗ ΠΟΛΥΦΥΤΟΥ	ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ
ΛΙΜΝΗ ΒΕΓΟΡΙΤΙΔΑ	ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ
ΛΙΜΝΗ ΒΕΓΟΡΙΤΙΔΑ	ΠΕΡΙΦΕΡΕΙΑ ΚΕΝΤΡΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ
ΛΙΜΝΗ ΚΟΡΩΝΕΙΑ	ΠΕΡΙΦΕΡΕΙΑ ΚΕΝΤΡΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ
ΛΙΜΝΗ ΜΙΚΡΗ ΠΡΕΣΠΑ	ΠΕΡΙΦΕΡΕΙΑ ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ

viii)*Find all the rivers that cross through the municipality of Heraklion (Δήμος Ηρακλείου).*

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX geowb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
```

```
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>

SELECT  ?riverName
WHERE
{
?m rdf:type gag:Δήμος ;
   gag:έχει_επίσημο_όνομα "ΔΗΜΟΣ ΗΡΑΚΛΕΙΟΥ" ;
   gag:έχει_γεωμετρία ?municipalityGeo.

?river a geowb:Ποτάμι ;
     geowb:είναι_το_υδάτινο_σώμα ?b.
?b geowb:έχει_όνομα ?riverName;
     geo:hasGeometry ?riverGeo.
?riverGeo geo:asWKT ?riverWKT.

FILTER(strdf:crosses(strdf:transform(?riverWKT,
epsg:4326),strdf:buffer(?municipalityGeo, 0, uom:metre)))
}
```

riverName
ΓΑΖΑΝΟΣ Ρ.
ΚΑΡΤΕΡΟΣ Π.

Exercise 2

In order to build an OWL 2 ontology for the given part of OpenStreetMap (OSM), I firstly inspected the existed GeoSparql ontology in protégé. So, under superclass “Spatial-Object” are defined 2 classes, the “Feature”, which contains all feature type, and “Geometry”, which contains all geometry types.
In the next step, I added the given features of OSM as subclasses of “Fearute” class.

- Places
- Natural Features
- Waterways
- Land use and land cover
- Bodies of water

For these created subclasses of “Feature” that represent the first layer in OSM, I then defined their geometry type according to the instructions of OSM:

- Places – Point Features
- Natural Features – Point Features
- Waterways – Line Features
- Land use and land cover – Polygon Features
- Bodies of water – Polygon Features

For all the geometry features, GeoSPARQL has as subclasses of “Geometry” the :

- Point > Geometry > Geometry
- Line String > Curve > Geometry > Geometry
- Polygon > Surface > Geometry > Geometry

So, for each feature subclass I use the axiom:

- Places subClassOf defaultGeometry only Point
- Natural Features subClassOf defaultGeometry only Point
- Waterways subClassOf defaultGeometry only Line String
- Land use and land cover subClassOf defaultGeometry only Polygon
- Bodies of water subClassOf defaultGeometry only Polygon

Under each created subclass of “Feature” I also added as subclasses the remaining subfeatures. For example, for subclass named “Waterways” I added the subclasses:

- River
- Stream
- Canal
- Drain

For subclasses of “Feature” named “Waterways” and “Places” I added the data properties hasWidth and hasPopulation correspondingly. The domain and range of these data properties are given as follows:

- hasWidth : Domain : class “Waterways”
  Range : integer

- hasPopulation: Domain : class “Places”
  Range : integer

Finally, I added the common attributes and the attributes that were specific to the layers and were mentioned in the pdf as datatype properties.

- hasId : Domain : “Feature”
  Range : xsd:string
- hasOsm_id Domain : “Feature”
  Range : xsd:string
- hasCode Domain : “Feature”
  Range : xsd:integer
- hasFclass Domain : “Feature”
  Range : xsd:string
- hasName Domain : “Feature”
  Range : xsd:string

Exercise 3

For the purpose of this exercise, I downloaded from the data portal of GEODATA- gov the dataset with title "*Beaches with Blue Flags (2009)*". This dataset contains the positions and other elements of the coasts which were awarded the blue flag for the year 2009.

https://geodata.gov.gr/en/dataset/aktes-me-galazia-semaia-2009

Then, following the given from lecture command lines I applied the GeoTriples to tranform it into RDF model. When I opened it for inspection, I noticed that the attributes of longitude and latitude were in string format, so I changed them into integers in order to use them in the following queries.
Bellow are given the queries along with the instructions of the task they carry through. The KML files that they output are attached in the zip file.
geo

a) Find the beaches awarded with blue flag that belong to region of Attiki.

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX wb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>
PREFIX bf:<http://blueflag.org/ontology#>

SELECT  ?beachName ?beachWKT
WHERE{
?beach bf:hasWATERNAME  ?beachName;
  geo:hasGeometry/geo:asWKT ?beachWKT.

?region a gag:Περιφέρεια;
  gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΑΤΤΙΚΗΣ" ;
  gag:έχει_γεωμετρία ?geoRegion.


FILTER(  strdf:contains(strdf:buffer(?geoRegion,  0,  uom:metre),
?beachWKT))

}
```

b) Find the beaches awarded with blue flag that belong to region of Attiki, which also don’t belong to the municipality of Glyfada.

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX wb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>
PREFIX bf:<http://blueflag.org/ontology#>

SELECT  ?beachName ?beachWKT
WHERE{
?beach bf:hasWATERNAME  ?beachName;
  geo:hasGeometry/geo:asWKT ?beachWKT.


  ?region a gag:Περιφέρεια;
  gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΑΤΤΙΚΗΣ" .

  ?m rdf:type gag:Δήμος ;
  gag:έχει_γεωμετρία ?municipalityGeo;
  gag:ανήκει_σε/gag:ανήκει_σε ?region .

  ?mg rdf:type gag:Δήμος ;
  gag:έχει_επίσημο_όνομα "ΔΗΜΟΣ ΓΛΥΦΑΔΑΣ" ;

FILTER( (strdf:contains(strdf:buffer(?municipalityGeo, 0, uom:metre),
?beachWKT)) && (?m != mg) )

}
```

c) Find the beaches awarded with blue flag that belong to region of Crete, which also have longitude less than 25.

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX wb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>
PREFIX bf:<http://blueflag.org/ontology#>

SELECT  ?beachName ?beachWKT ?longitude
WHERE{
?beach bf:hasWATERNAME  ?beachName;
  bf:hasLongitude  ?longitude;
  geo:hasGeometry/geo:asWKT ?beachWKT.

?region a gag:Περιφέρεια;
  gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΚΡΗΤΗΣ";
  gag:έχει_γεωμετρία ?geoRegion.

FILTER(      (strdf:contains(strdf:buffer(?geoRegion,      0,      uom:metre),
?beachWKT) && (?longitude < 25)  )

}
```

d) Find the 10 beaches awarded with blue flag that belong to region of Central Macedonia and also have the smallest longitude.

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX wb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>
PREFIX bf:<http://blueflag.org/ontology#>

SELECT  ?beachName ?beachWKT ?longitude
WHERE{
  ?beach bf:hasWATERNAME  ?beachName;
  bf:hasLongitude  ?longitude;
  geo:hasGeometry/geo:asWKT ?beachWKT.

  ?region a gag:Περιφέρεια;
  gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΚΕΝΤΡΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ";
  gag:έχει_γεωμετρία ?geoRegion.

  FILTER(strdf:contains(strdf:buffer(?geoRegion, 0, uom:metre),
?beachWKT))
}
ORDER BY DESC(?longitude)
LIMIT 10
```

e) Find the 5 beaches awarded with blue flag that belong to region of Ionian Islands and also have the biggest latitude.

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX gag: <http://geo.linkedopendata.gr/gag/ontology/>
PREFIX geo: <http://www.opengis.net/ont/geosparql#>
PREFIX wb: <http://geo.linkedopendata.gr/water-bodies/ontology/>
PREFIX geof: <http://www.opengis.net/def/function/geosparql/>
PREFIX strdf: <http://strdf.di.uoa.gr/ontology#>
PREFIX uom: <http://www.opengis.net/def/uom/OGC/1.0/>
PREFIX epsg: <http://www.opengis.net/def/crs/EPSG/0/>
PREFIX bf:<http://blueflag.org/ontology#>


SELECT  ?beachName ?beachWKT ?municipalityName
WHERE{
?beach bf:hasWATERNAME  ?beachName;
  bf:hasLatitude  ?latitude;
  geo:hasGeometry/geo:asWKT ?beachWKT.

?region a gag:Περιφέρεια;
  gag:έχει_επίσημο_όνομα "ΠΕΡΙΦΕΡΕΙΑ ΙΟΝΙΩΝ ΝΗΣΩΝ".

?m rdf:type gag:Δήμος ;
  gag:έχει_επίσημο_όνομα ?municipalityName ;
  gag:έχει_γεωμετρία ?municipalityGeo;
  gag:ανήκει_σε/gag:ανήκει_σε ?region .

FILTER(  strdf:contains(strdf:buffer(?municipalityGeo,  0,  uom:metre),
?beachWKT))

}
ORDER BY ?latitude
LIMIT 5
```