Assignment 3
Group 52

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Before starting assignment 3, we changed the ER and ontology by introducing a missing relationship; each division now belongs to a single department. Hence Teachers only have a relation to division.

The first step of converting the data to RDF consisted of creating triples for the new entities Division and Department, which by inspection was found to be the union of corresponding columns in the SeniorTeachers and TeachingAssistants tables. Then some additional steps. Then we also merged some data tables according to our ER.

We used a library called *rdflib* in order to easily work with graph data in Python. In order to make the code more concise and manageable, we defined dictionary mappings; csv column names to property names as in our ontology, and foreign key mappings. With these mappings defined, we could define a single function *add_triples* to be applied on each csv data file. See *GenRDF.ipynb* for full code implementation.

In the following pages are the requested SPARQL queries and corresponding results.

1:

```
select ?programme ?name ?director ?department where {
    ?programme ns1:HasDirector ?director.
    ?programme ns1:OfDepartment ?department.
    ?programme ns1:programmeName ?name.
}
```

result:

	programme	name	director	department
1	ns1:Programme-10061	"P-61"	ns1:SeniorTeacher-19680712-0028	ns1:Department-D7
2	ns1:Programme-10054	"P-54"	ns1:SeniorTeacher-19630126-0001	ns1:Department-D6
3	ns1:Programme-10031	"P-31"	ns1:SeniorTeacher-19650303-0019	ns1:Department-D4
4	ns1:Programme-10074	"P-74"	ns1:SeniorTeacher-19601021-0018	ns1:Department-D8
5	ns1:Programme-10052	"P-52"	ns1:SeniorTeacher-19611219-0014	ns1:Department-D6
6	ns1:Programme-10033	"P-33"	ns1:SeniorTeacher-19570828-0008	ns1:Department-D4
7	ns1:Programme-10042	"P-42"	ns1:SeniorTeacher-19620831-0024	ns1:Department-D5
8	ns1:Programme-10013	"P-13"	ns1:SeniorTeacher-19690408-0009	ns1:Department-D2
9	ns1:Programme-10032	"P-32"	ns1:SeniorTeacher-19570826-0012	ns1:Department-D4
10	ns1:Programme-10021	"P-21"	ns1:SeniorTeacher-19570615-0011	ns1:Department-D3
11	ns1:Programme-10073	"P-73"	ns1:SeniorTeacher-19600814-0002	ns1:Department-D8
12	ns1:Programme-10072	"P-72"	ns1:SeniorTeacher-19660630-0020	ns1:Department-D8
13	ns1:Programme-10071	"P-71"	ns1:SeniorTeacher-19610620-0006	ns1:Department-D8
14	ns1:Programme-10012	"P-12"	ns1:SeniorTeacher-19610623-0005	ns1:Department-D2
15	ns1:Programme-10014	"P-14"	ns1:SeniorTeacher-19560812-0016	ns1:Department-D2
16	ns1:Programme-10011	"P-11"	ns1:SeniorTeacher-19620424-0026	ns1:Department-D2
17	ns1:Programme-10051	"P-51"	ns1:SeniorTeacher-19580515-0017	ns1:Department-D6
18	ns1:Programme-10001	"P-01"	ns1:SeniorTeacher-19620522-0023	ns1:Department-D1
19	ns1:Programme-10034	"P-34"	ns1:SeniorTeacher-19610918-0027	ns1:Department-D4
20	ns1:Programme-10041	"P-41"	ns1:SeniorTeacher-19580218-0007	ns1:Department-D5
21	ns1:Programme-10053	"P-53"	ns1:SeniorTeacher-19600905-0003	ns1:Department-D6

2:

```
select ?student ?name where {
    ?assignment ns1:AssignedTo ?teacher.
    ?teacher ns1:teacherID ?id.
    ?student ns1:studentID ?id.
    ?student ns1:name ?name.
    ?assignment ns1:AssignedOn ?courseInstance.
    ?courseInstance ns1:studyPeriod "4.0"^^xsd:double.
    ?courseInstance ns1:academicYear "2023-2024".
    ?courseInstance ns1:InstanceOf ?course.
    ?course ns1:OfDivision ns1:Division-D3-2.
}
```

result:

	student	name
1	ns1:Student-19770713-0042	"TA 42"
2	ns1:Student-19901026-0111	"TA 111"
3	ns1:Student-19910214-0084	"TA 84"
4	ns1:Student-19780602-0035	"TA 35"
5	ns1:Student-19751018-0039	"TA 39"
6	ns1:Student-19900902-0090	"TA 90"

3:

```
select ?teacherAssignment ?name ?hours  where {
    ?instance ns1:InstanceOf ns1:Course-1015 .
    ?instance ns1:studyPeriod "1.0"^^xsd:double.
    ?instance ns1:academicYear "2018-2019".
    ?teacherAssignment ns1:AssignedOn ?instance.
    ?teacherAssignment ns1:reportedHours ?hours.
    ?teacherAssignment ns1:AssignedTo ?teacher.
    ?teacher ns1:name ?name
    FILTER(?hours>120)
}
```

result:

	teacherAssignment	name	hours
1	ns1:TeacherAssignment-I-2063-19790702-0038	"TA 38"	"144.0"^^xsd:double
2	ns1:TeacherAssignment-I-2063-19580218-0007	"Teacher 7"	"275.0"^^xsd:double
3	ns1:TeacherAssignment-I-2698-19660630-0020	"Teacher 20"	"257.0"^^xsd:double
4	ns1:TeacherAssignment-I-2698-19780424-0057	"TA 57"	"126.0"^^xsd:double
5	ns1:TeacherAssignment-I-371-19650303-0019	"Teacher 19"	"221.0"^^xsd:double
6	ns1:TeacherAssignment-I-371-19750102-0059	"TA 59"	"137.0"^^xsd:double

4:

```
select ?student where {
    ?reg ns1:StudentRegistered ?student.
    ?reg ns1:CourseRegistered ?courseInstance.
    ?courseInstance ns1:instanceID "I-910".
    MINUS {
      ?courseInstance ns1:instanceID "I-911".
    }
}
```

result:

	student
1	ns1:Student-19921201-0094

5:

```
select ?programme (COUNT(?course) AS ?sum) where {
    ?programmeCourse ns1:CourseIn ?course.
    ?programmeCourse ns1:ProgrammeIn ?programme
}
GROUP BY ?programme
ORDER BY DESC(?sum)
```

result:

	programme	sum
1	ns1:Programme-10011	"389"^^xsd:integer
2	ns1:Programme-10013	"319"^^xsd:integer
3	ns1:Programme-10054	"319"^^xsd:integer
4	ns1:Programme-10071	"319"^^xsd:integer
5	ns1:Programme-10032	"318"^^xsd:integer
6	ns1:Programme-10073	"318"^^xsd:integer
7	ns1:Programme-10072	"318"^^xsd:integer
8	ns1:Programme-10001	"316"^^xsd:integer
9	ns1:Programme-10012	"314"^^xsd:integer
10	ns1:Programme-10051	"305"^^xsd:integer
11	ns1:Programme-10014	"214"^^xsd:integer
12	ns1:Programme-10041	"214"^^xsd:integer
13	ns1:Programme-10031	"212"^^xsd:integer
14	ns1:Programme-10074	"211"^^xsd:integer
15	ns1:Programme-10042	"209"^^xsd:integer
16	ns1:Programme-10033	"208"^^xsd:integer
17	ns1:Programme-10061	"207"^^xsd:integer
18	ns1:Programme-10053	"206"^^xsd:integer
19	ns1:Programme-10034	"206"^^xsd:integer
20	ns1:Programme-10021	"205"^^xsd:integer
21	ns1:Programme-10052	"203"^^xsd:integer

6a:

```
select (COUNT(*) as ?num_senior_teachers) where {
    ?st rdf:type ns1:SeniorTeacher.
}
```

result: 30

6b:

```
select (COUNT(DISTINCT ?id) as ?num_people) where {
    {
        ?teacher rdf:type ns1:Teacher.
      ?teacher ns1:teacherID ?id.
      } UNION {
        ?student rdf:type ns1:Student.
      ?student ns1:studentID ?id.
      }
}
```

result: 440