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Semantic Web Exam – 28 January 2022

Q8. Identify two different assertions that would make the ontology inconsistent.

a) :edificioA rdf:type :building
:edificioA :hasLocation :pisa
:edificioA :hasLocation :bari

The inconsistency is generated violating exact cardinality constraint. A *Building* can be associated with exactly one *Location* through property *hasLocation*.

b) :marioBianchi rdf:type :director
:marioBianchi rdf:type :graduateFellow

This assertion makes the ontology inconsistent because *director* and *GraduateFellow* are disjoint classes.

Q9. Define the complex role inclusion axiom capturing the fact that if an employee has an office that is contained in a building that is assigned to an institute that is part of a research organisation, then the employee has a contract with that research organisation.

(isHostedIn o isOfficeOf o isBuildingOf o isInstituteOf) $\sqsubseteq$ hasContractWith

Q10. Verify and explain whether or not the created ontology (including the complex role inclusion axiom defined in Q9) satisfies the global restrictions on the axioms of an OWL 2 DL ontology.

The restriction on owl:topDataProperty is satisfied for two reasons: the ontology does not include any axiom on owl:topDataProperty and super-properties of owl:topDataProperty do not occur in the ontology.

Restrictions on datatypes are statisfied because: the OWL 2 datatype map contains each datatype that occurs in the ontology and no data ranges are defined than is satisfied the condition “datatype definitions are acyclic”.

Class expressions and axioms of the following types contain only simple object properties: *ObjectMinCardinality*, *ObjectMaxCardinality*, *ObjectExactCardinality*, *ObjectHasSelf*, *FunctionalObjectProperty*, *InverseFunctionalObjectProperty*, *IrreflexiveObjectProperty*, *AsymmetricObjectProperty*, and *DisjointObjectProperties*.

No kind of composite object properties is used in them: the object properties that they may contain are simple because they do not have any sub-property that is the right-hand side of a complex role inclusion axiom. So that the “Restriction on Simple Roles” is satisfied.

Including the complex role inclusion axiom “Restriction on Simple Roles” is not satisfied.

The “Restriction on the Property Hierarchy” is satisfied because in the ontology there are not cyclic definitions involving object subproperty axioms with property chains.

No anonymous individuals occur in the ontology than “Restrictions on Anonymous Individuals” are satisfied.

Q11. Write the following queries in SPARQL:

Q11.1. Find all the offices that host at least one graduate fellow and order the results by employee ID.

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

SELECT ?employee_ID ?office
WHERE {
?office rdf:type :Office ;
:hosts ?graduate_Fellow .

?graduate_Fellow rdf:type :GraduateFellow ;
:hasEmployeeID ?employee_ID .
}
ORDER BY ?employee_ID
```

Q11.2. Find all the senior researchers with ID lower than 5000 who are members of the laboratory named "AIMH".

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX : <http://www.semanticweb.org/research-organization#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?seniorResearcher ?employeeID
```

```
WHERE {
?seniorResearcher :hasEmployeeID ?employeeID ;
rdf:type :SeniorResearcher ;
:isMemberOfLaboratory :AIMH .

FILTER (?employeeID < "5000"^^xsd:positiveInteger)
}
```

Q11.3. Find all the laboratories that have a total number of research group greater than 2.

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

SELECT ?laboratory (COUNT(?member) AS ?totMembers)

WHERE {
?laboratory rdf:type :Laboratory .
?member :isMemberOfLaboratory ?laboratory .
}

GROUP BY ?laboratory
HAVING (?totMembers >2)
```