

## Exercise 5

(a) Write an OWL ontology that formalizes the domain described at point (a) of Exercise 4.

(b) Add to the above ontology the axioms formalizing the following statements:

1. City and Division are disjoint classes;
2. every manager manages at least three employees;
3. every division is located in exactly one city;
4. every employee works with at least one man and works with at least one woman;
5. every manager leads at most one division;
6. RomanManager is the class of managers who lead a division located in Rome.

Then, tell whether the resulting OWL ontology is redundant, i.e.: can some of the axioms constituting the ontology be deleted without changing the meaning of the ontology? if so, identify and list such axioms.

2)

1) Declaration ( $\text{Class}(\text{myrs:Employee})$ )Declaration ( $\text{Class}(\text{myrs:Manager})$ )Declaration ( $\text{Class}(\text{myrs:TopManager})$ )Declaration ( $\text{Class}(\text{myrs:Division})$ )Declaration ( $\text{Class}(\text{myrs:Man})$ )Declaration ( $\text{Class}(\text{myrs:Woman})$ )Declaration ( $\text{Class}(\text{myrs:City})$ )2) subClassOf ( $\text{myrs:TopManager}$   $\text{myrs:Manager}$ )  
subClassOf ( $\text{myrs:Manager}$   $\text{myrs:Employee}$ )3) Declaration ( $\text{ObjectProperty}(\text{myrs:worksWith})$ )Declaration ( $\text{ObjectProperty}(\text{myrs:livesIn})$ )Declaration ( $\text{ObjectProperty}(\text{myrs:isManagerOf})$ )Declaration ( $\text{ObjectProperty}(\text{myrs:leadsDivision})$ )Declaration ( $\text{ObjectProperty}(\text{myrs:locatedIn})$ )4) subObjectPropertyOf ( $\text{myrs:isManagerOf}$   $\text{myrs:worksWith}$ )5) subClassOf ( $\text{ObjectSomeValueFrom}(\text{ObjectInverseOf}(\text{myrs:isManager}))$   $\text{owl:Thing}$ )  $\text{myrs:Manager}$ )subClassOf ( $\text{ObjectSomeValueFrom}(\text{myrs:isManager})$   $\text{owl:Thing}$ )  $\text{myrs:Employee}$ )6) subClassOf ( $\text{ObjectSomeValueFrom}(\text{ObjectInverseOf}(\text{myrs:worksWith}))$   $\text{owl:Thing}$ )  $\text{myrs:Employee}$ )subClassOf ( $\text{ObjectSomeValueFrom}(\text{myrs:worksWith})$   $\text{owl:Thing}$ )  $\text{myrs:Employee}$ )7) subClassOf ( $\text{ObjectSomeValueFrom}(\text{ObjectInverseOf}(\text{myrs:livesIn}))$   $\text{owl:Thing}$ )  $\text{myrs:Person}$ )subClassOf ( $\text{ObjectSomeValueFrom}(\text{myrs:livesIn})$   $\text{owl:Thing}$ )  $\text{myrs:City}$ )8) subClassOf ( $\text{ObjectSomeValueFrom}(\text{ObjectInverseOf}(\text{myrs:locatedIn}))$   $\text{owl:Thing}$ )  $\text{myrs:Division}$ )subClassOf ( $\text{ObjectSomeValueFrom}(\text{myrs:locatedIn})$   $\text{owl:Thing}$ )  $\text{myrs:City}$ )9) Classification ( $\text{myrs:Manager}$   $\text{myrs:Jane}$ )10) Classification ( $\text{myrs:Employee}$   $\text{myrs:Bob}$ )Classification ( $\text{myrs:Employee}$   $\text{myrs:Ann}$ )11) ObjectPropertyAssertion ( $\text{myrs:isManagerOf}$   $\text{myrs:Jane}$   $\text{myrs:Bob}$ )12) ObjectPropertyAssertion ( $\text{myrs:livesIn}$   $\text{myrs:Jane}$   $\text{myrs:Rome}$ )

- 11) ObjectPropertyAssertion(myns:isManagerOf myns:Jane myns:Roman)
- 12) ObjectPropertyAssertion(myns:LivesIn myns:Jane myns:Rome)
- 13) ObjectPropertyAssertion(myns:LeadsDivision myns:May myns:XYZ)
- 14) ObjectPropertyAssertion(myns:LocatedIn myns:ABC myns:Upples)

b)

- 1) DisjointClasses(myns:City myns:Division)
- 2) ObjectMinCardinality(3 myns:isManagerOf)
- 3) ObjectExactCardinality(1 myns:locatedIn)
- 4) subClassOf(myns:Employee ObjectIntersectionOf(ObjectSomeValuesFrom(myns:worksWith myns:Man  
ObjectSomeValuesFrom(myns:worksWith myns:Woman)))
- 5) subClassOf(myns:Manager ObjectMaxCardinality(1 myns:leadsDivision myns:Division))
- 6) EquivalentClasses(myns:RomanManager ObjectIntersectionOf(myns:Manager ObjectSomeValuesFrom(myns:leadsDivision  
ObjectHasValue(myns:locatedIn myns:Rome))))