

```
@prefix :
<http://www.semanticweb.org/c1544657/ontologies/2017/10/untitled-
ontology-19#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix xml: <http://www.w3.org/XML/1998/namespace> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@base <http://www.semanticweb.org/c1544657/ontologies/2017/10/untitled-
ontology-19> .
```

```
<http://www.semanticweb.org/c1544657/ontologies/2017/10/untitled-
ontology-19> rdf:type owl:Ontology .
```

```
#####
#
#   Object Properties
#
#####
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-
ontology-9#hasChild
```

```
#####
#
#   Data properties
#
#####
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-
ontology-9#hasAge
```

```
#####
#
#   Classes
#
#####
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-
ontology-9#Adult
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-
9#Adult> rdf:type owl:Class ;
```

```
rdfs:subClassOf
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Child
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Child> rdf:type owl:Class ;
```

```
rdfs:subClassOf
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Father
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Father> rdf:type owl:Class ;
```

```
rdfs:subClassOf
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent> ;
```

```
owl:disjointWith
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#FemalePerson> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Grandmother> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Mother> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#FemalePerson
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#FemalePerson> rdf:type owl:Class ;
```

```
rdfs:subClassOf
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Adult> ;
```

```
owl:disjointWith
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Grandmother
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Grandmother> rdf:type owl:Class ;
```

```
rdfs:subClassOf
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Mother> ;
```

```
owl:disjointWith
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson> rdf:type owl:Class ;
```

```
rdfs:subClassOf
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> ;
```

```
owl:disjointWith
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Mother> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Mother
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Mother> rdf:type owl:Class ;
```

```
rdfs:subClassOf
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#FemalePerson> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent> rdf:type owl:Class ;
```

```
rdfs:subClassOf
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#ParentOfAnAdult
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#ParentOfAnAdult> rdf:type owl:Class ;
```

```
rdfs:subClassOf
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> rdf:type owl:Class .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Teenager
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Teenager> rdf:type owl:Class ;
```

```
rdfs:subClassOf
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> .
```

```
#####  
#  
#   Individuals  
#  
#####
```

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Jacob>

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Jacob>> rdf:type

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Child>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person>> ,

owl:NamedIndividual ;

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasAge>> 5 .

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Jemima>

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Jemima>> rdf:type

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Adult>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#FemalePerson>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Grandmother>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Mother>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#ParentOfAnAdult>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person>> ,

owl:NamedIndividual ;

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasAge>> 72 ;

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasChild>>

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Joanna> ,

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Joel> .

http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Jeremiah

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Jeremiah> rdf:type

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Adult> ,

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson> ,

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> ,

owl:NamedIndividual ;

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasAge> 23 .

http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Joanna

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Joanna> rdf:type

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Adult> ,

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#FemalePerson> ,

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Mother> ,

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent> ,

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#ParentOfAnAdult> ,

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> ,

owl:NamedIndividual ;

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasAge> 42 ;

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasChild>
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Jeremiah> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Judith> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Joel
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Joel> rdf:type
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Adult> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Father> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person> ,
```

```
owl:NamedIndividual ;
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasAge> 38 ;
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasChild>
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Jacob> .
```

```
### http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#John
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#John> rdf:type
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Adult> ,
```

```
<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Father> ,
```

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#MalePerson>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Parent>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#ParentOfAnAdult>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person>> ,

owl:NamedIndividual ;

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasAge>> 73 ;

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasChild>>

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Joanna>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Joel>> .

<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Judith>

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Judith>> rdf:type

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Adult>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#FemalePerson>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Person>> ,

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#Teenager>> ,

owl:NamedIndividual ;

<<http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#hasAge>> 19 .

Generated by the OWL API (version 3.4.2)
<http://owlapi.sourceforge.net>

Task 2:

i)

a) What we could do is instead of having ParentOfAnAdult equivalent to (hasChild some Adult) is:

Instead of having Parent as the disjoint union of Father and mother, have it equivalent to (hasChild some Person). Create two new classes called MotherOfAnAdult(Mother that hasChild some Adult) and FatherOfAnAdult(Father that hasChild some Adult). Make ParentOfAnAdult a disjoint union of MotherOfAnAdult and FatherOfAnAdult.

b) PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX : <http://www.semanticweb.org/andrew/ontologies/2016/9/untitled-ontology-9#>

```
SELECT DISTINCT ?individual
      WHERE {?individual rdf:type owl:NamedIndividual .
             ?individual:hasChild ?child.
             ?child:hasAge ?age .
             FILTER(?age>=18)
            }
```

When using SPARQL we don't need to start the reasoner in order to see the relationships. We just create a query for the relationship we need as in the case of ParentOfAnAdult.

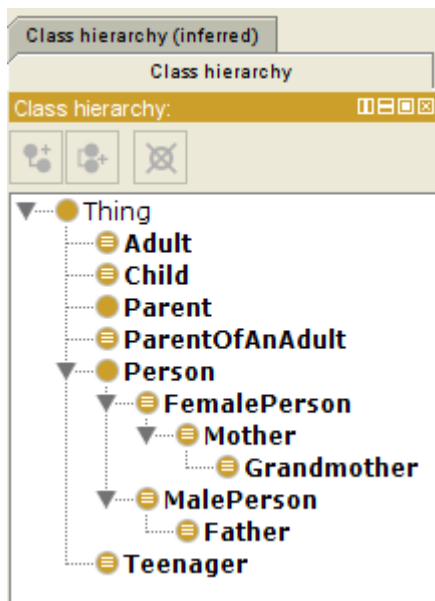
There are many different ways to define the relationships between the classes which provide the same results. The choice is always upon the individual creating the ontology but a particular way can't be explicitly correct.

ii)

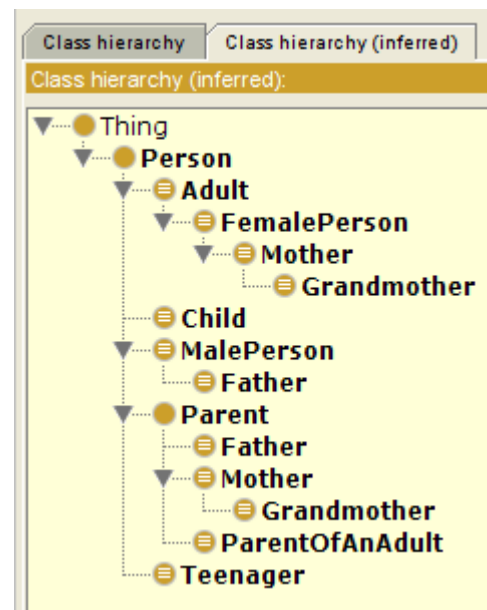
In protégé class hierarchy is the primary navigation device. The classes are represented as nodes in a tree. If a class doesn't have a superclass it is shown as a subclass of owl: Thing. If the classes are equivalent they are shown together under their superclass.

Before we start the reasoner inferred class hierarchy is empty. When we start the reasoner, it identifies the relationships between the classes. The inferred class hierarchy shows the correct relations between the classes.

Before the reasoner:



After the reasoner:



In the class hierarchy we have the Adult, Child, Teenager, parent and person as subclasses of thing. Parent has one subclass which is ParentOfAnAdult.

The subclasses of femaleperson and maleperson remain the same.

The only subclass of Thing is Person. The differences are that now Teenager, Adult and Child are all subclasses of Person. The class FemalePerson has now become a subclass of Adult. The parent class now has 3 subclasses which are mother and father that were previously subclasses of FemalePerson and MalePerson respectively. ParentOfAnAdult is also a subclass of parent now.