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# Introduction to Artificial Intelligence
*Laboratory activity 2017-2018*

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# Contents

# Chapter 1

# Installing the tool

Protégé is a free, open-source ontology editor and framework for building intelligent systems. It is supported by a strong community of academic, government, and corporate users, who use Protégé to build knowledge-based solutions in areas as diverse as biomedicine, e-commerce, and organizational modeling.

Why Protégé?

Protégé's plug-in architecture can be adapted to build both simple and complex ontology-based applications. Developers can integrate the output of Protégé with rule systems or other problem solvers to construct a wide range of intelligent systems. Most important, the Stanford team and the vast Protégé community provide a good helping hand.

The steps for installation are:

1. Go to products page on the: Protégé Website

2. Click the "Download for Linux" button to download the tar.gz file to your machine.

3. To unpack the archive, either use your file explorer and double-click on the archive, and extract it to the desired location, or type in a terminal window:

```
tar zxvf protege-5.0.0-linux.tar.gz
```

The tool was installed on:

```
Ubuntu 17.0
```

Running the tool

To launch Protege Desktop, double-click on the run.sh in the Protege folder in the file explorer, or type:

```
./run.sh
```

in a terminal window, once you have changed the directory to the Protege folder.

# Chapter 2

# Running and understanding examples and conceptual instrumentation

Protégé Desktop is a feature rich ontology editing environment with full support for the OWL 2 Web Ontology Language, and direct in-memory connections to description logic reasoners like HermiT and Pellet.

Protégé Desktop supports creation and editing of one or more ontologies in a single workspace via a completely customizable user interface. Visualization tools allow for interactive navigation of ontology relationships. Advanced explanation support aids in tracking down inconsistencies. Refactor operations available including ontology merging, moving axioms between ontologies, rename of multiple entities, and more.

This is a quick trip through an example of ontology about pizzas and their toppings that contains all constructs required for the various versions of the Pizza Tutorial run by Manchester University.
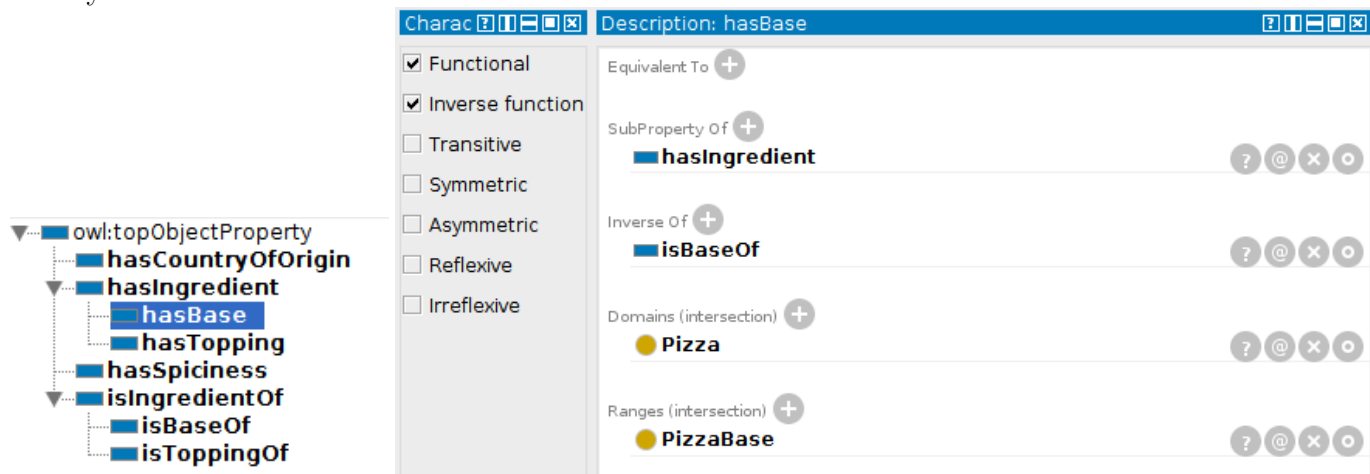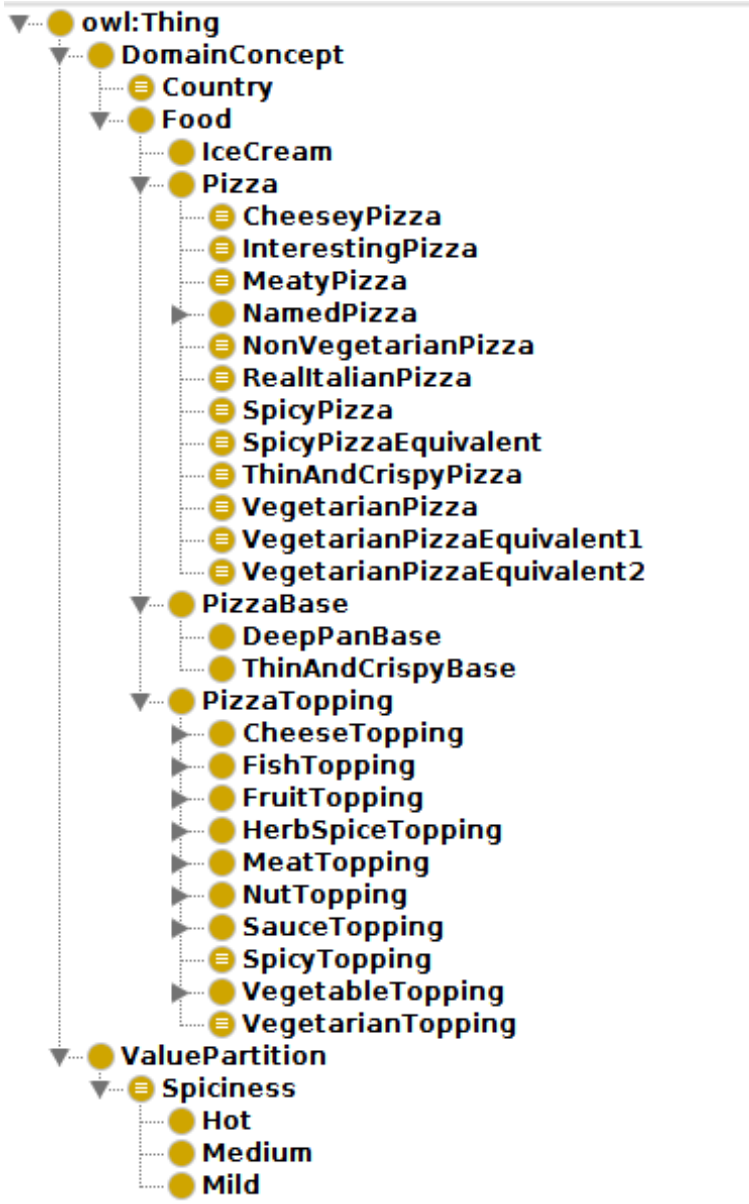
We can observe that there are two main classes, DomainConcept having Country and Food as subclasses, and a ValuePartition with Spiciness subclass.

Having the previously shown Object Properties list, we deduce that a Pizza can have ingredients, defined as PizzaBase and PizzaTopping based on the hasBase and hasTopping properties. The domain and range are defined as Pizza and PizzaBase respectively, hence the inverse function of hasBase should be isBaseOf, having the domain PizzaBase and the range Pizza. By the "Functional" characteristic it is implied that a Pizza might only have one PizzaBase.

By applying some DL Queries on the ontology, we can obtain a certain piece of information, resulted from the relationships described within it, using the properties. First of all, we need to start a Reasoner:
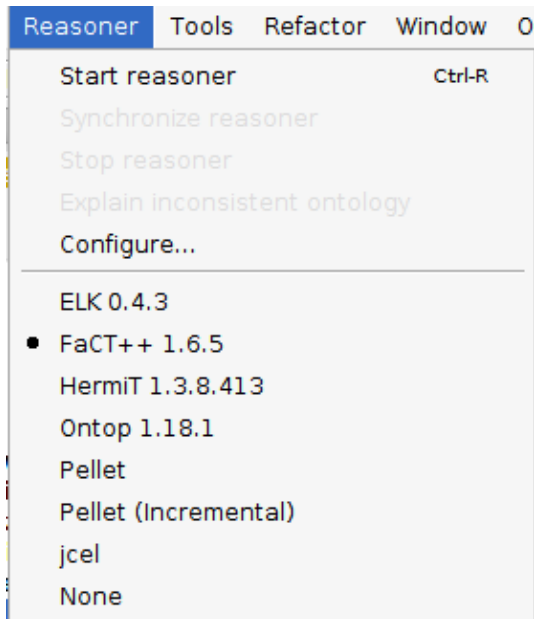
Then, we can execute a certain query to obtain the expected result.
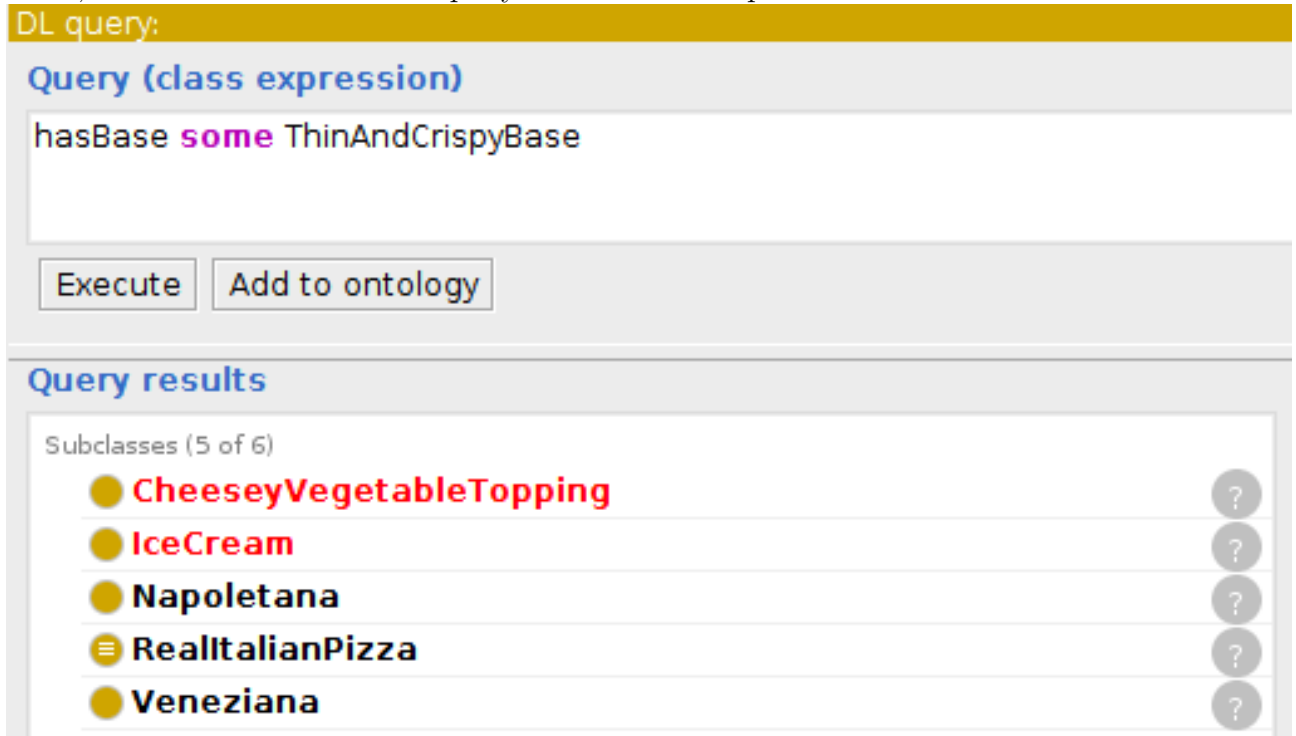


We can also observe that some answers are colored in red, meaning that there is some contradictory relationship defined regarding the highlighted elements. Note that if such situations are met in the ontology, it will not crash the program, but it will only notify the user.

Explanation for CheeseyVegetableTopping EquivalentTo owl:Nothing

- ● Show regular justifications    ● All justifications
- ○ Show laconic justifications    ○ Limit justifications to
                                        2

Explanation 1    ☐ Display laconic explanation

Explanation for: CheeseyVegetableTopping EquivalentTo owl:Nothing

CheeseyVegetableTopping **SubClassOf** CheeseTopping
CheeseyVegetableTopping **SubClassOf** VegetableTopping
CheeseTopping **DisjointWith** VegetableTopping

The explanation for the given answer can also be viewed by pressing the "?" button.



Explanation for Napoletana SubClassOf hasBase some ThinAndCrispyBase

- ● Show regular justifications    ● All justifications
- ○ Show laconic justifications    ○ Limit justifications to
                                        2

Explanation 1    ☐ Display laconic explanation

Explanation for: Napoletana SubClassOf hasBase some ThinAndCrispyBase

1) Napoletana **SubClassOf** NamedPizza                                          In NO other justifications
2)    NamedPizza **SubClassOf** Pizza                                            In NO other justifications
3)       Pizza **SubClassOf** hasBase **some** PizzaBase                         In ALL other justifications
4) Napoletana **SubClassOf** hasCountryOfOrigin **value** Italy                  In ALL other justifications
5) RealItalianPizza **EquivalentTo** Pizza **and** (hasCountryOfOrigin **value** Italy)   In ALL other justifications
6) RealItalianPizza **SubClassOf** hasBase **only** ThinAndCrispyBase            In ALL other justifications

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# Chapter 3

# Project description

## 3.1 Narrative description

Online stores are available 24x7, do not require travelling, provide a variety of items and services at a single store which is easy to access and look up. All these features have let these e-shops gain popularity from late 90's. Since then many attempts have been made to improve the experience of shoppers with the online shopping sites.
In this paper, I have tried to design an ontology using Protégé, in order to add new features in the shopping sites and answer the complex queries of the users making their life of shopping easier, but also helping the e-shop organize their products, keep the live stocks and keep track of the orders by sorting them based on the client's delivery adress.

The system implements a simulation of an online-shop ontology that keeps track of it's products state, information about the client and its orders, the providers of products and the relationship between individuals.

The project provides a system designed for both the clients and the e-shop itself. The clients can find easier the products they are interested in, the ontology design providing suggestion of products that might work with the ones already ordered and the estimated cost of the whole order. On the other side, the e-shop can organize the delivery of the client's orders, trying to find the closest order in the requested region and deliver them together, reducing the costs and time. It also helps in keeping the number of products available and the contract with the producers.

## 3.2 Top level design of the scenario
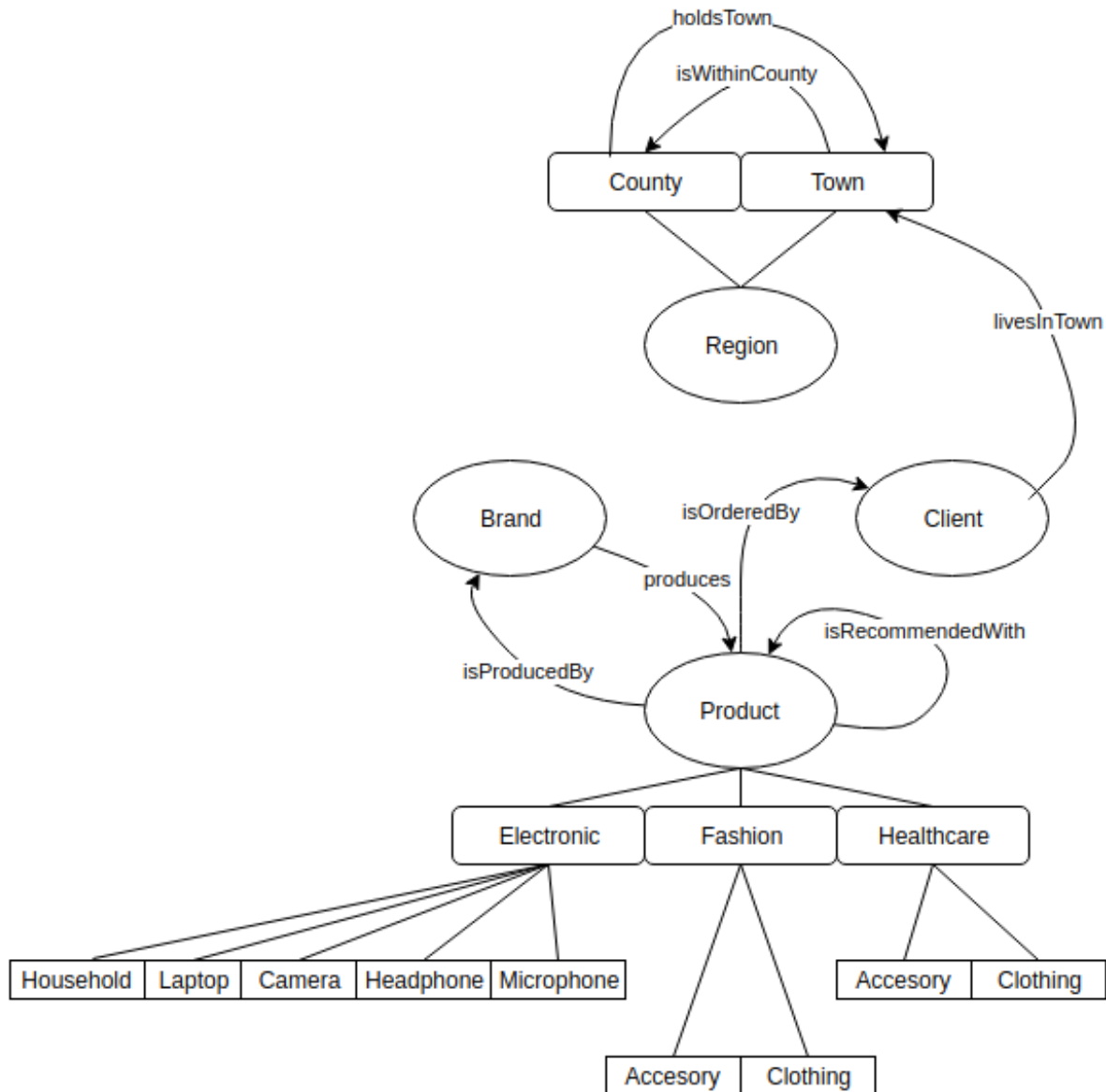


## 3.3 Knowledge acquisition

Examples of knowledge sources that I have used for this project include:

- A Practical Guide To Building OWL Ontologies Using Protege 4 and CO-ODE Tools Edition 1.3 : http://mowl-power.cs.man.ac.uk/protegeowltutorial/resources/

- Protege Desktop User Documentation: https://protegewiki.stanford.edu/wiki/Protege4UserDocs

## 3.4 Related work

eClassOWL is an OWL ontology for describing the types and properties of products and services on the Semantic Web (also known as the "Web of Linked Data"). eClassOWL is meant to

be used in combination with the GoodRelations ontology for e-commerce, which covers the commercial aspects of offers and demand, e.g. prices, payment, or delivery options.

eClassOWL is a project that has been initiated by Martin Hepp in 2003 and is now being hosted and maintained by the E-Business and Web Science Research Group at the Universität der Bundeswehr München.

For describing the nature and features of products, there are many established standards from traditional EDI environments, e.g. UNSPSC, eCl@ss, or RNTD. Among those, eCl@ss is the most sophisticated one, because it covers a wide range of products and services (more than 30,000 types) and defines a huge number of properties for products features (more than 5,000 properties). However, when we want to use such categorization standards for the Semantic Web, we have to make sure that we properly understand the meaning and structure of the existing standard and create a consistent and correct transformation. Fortunately for us, this work has already been done in the case of eCl@ss. For the full background on the underlying research, see the references on: http://www.heppnetz.de/projects/eclassowl/

# Chapter 4

# Implementation details

I have started by creating the diagram represented earlier, from which I deducted the classes, object properties, data properties and the relationships required between them.

We have 4 main classes for: Brand, Client, Product and Region, each one of them representing a set of "things".While the Brand and Client classes are stand-alone classes, only giving a clue about the type of instances that will be added to the ontology, the Product class is further divided into Electronic, Fashion and Heathcare subclasses, for a better description and view of the elements that are going to be added, named individuals. The Region class is divided as well into two subclasses, County and Town.

Class entities:
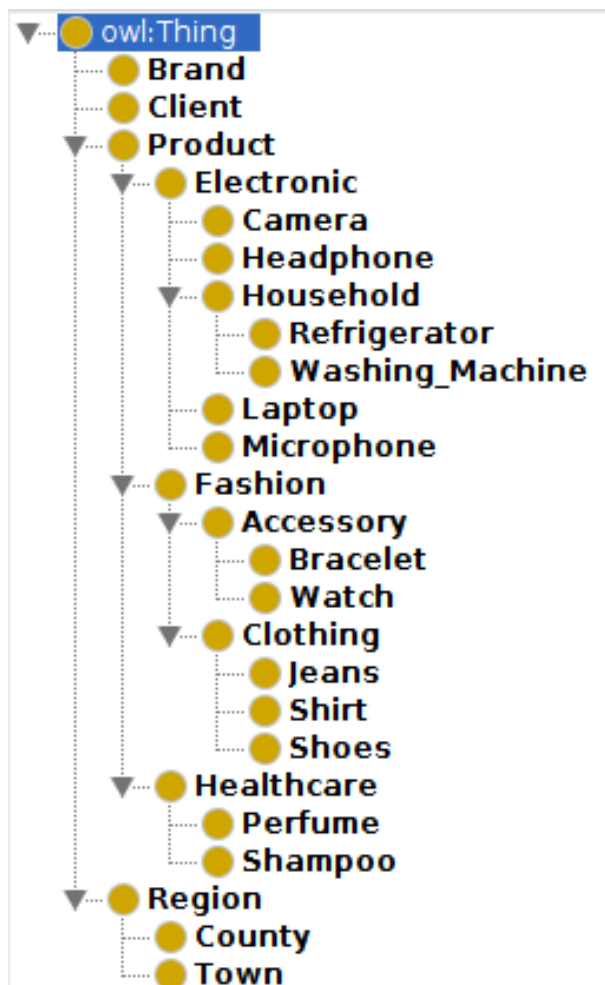


The linking between classes and instances is represented by the following

Object properties:
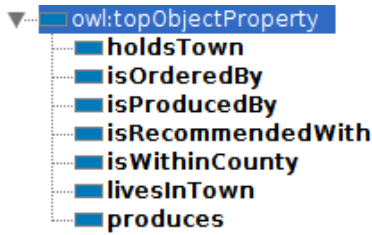


The "holdsTown" and "isWithinCounty" are two inverse properties, characteristic for County and Town classes. The domain of "holdsTown" is County, while the range is Town and vice-versa for the "isWithinCounty". The same applies to the "isProducedBy" and "produces", for Brand and Product.

Product and Client are connected using the "isOrderedBy" property, which helps in organizing the orders of a client and the availability of products.

An example of symmetric property is the "isRecommendedWith" property, which defines the set of suggestions for an order, products that could fit well with other products.

The characteristics of an instance are represented by Data properties which are self-explanatory:
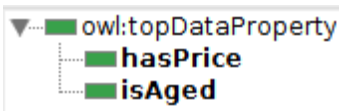


Below we can see some of the instances and properties defined on them:

# Chapter 5

# Tool expressivity

## 5.1 Introduction

Ontologies are used to capture knowledge about some domain of interest. An ontology describes the concepts in the domain and also the relationships that hold between those concepts. Different ontology languages provide different facilities.

An ontology consists of: Individuals, Properties, and Classes.

1. Individuals -objects in the domain in which we are interested.

2. Properties - binary relations on individuals - i.e. properties link two individuals together.

3. Classes - are interpreted as sets that contain individuals.

## 5.2 Properties

Ontology properties represent relationships. There are two main types of properties, Object properties and Datatype properties. Object properties are relationships between two individuals. We will focus on object properties for now:

1. Inverse Properties:
   Each object property may have a corresponding inverse property. If some property links individual a to individual b then its inverse property will link individual b to individual a.

2. Functional Properties:
   If a property is functional, for a given individual, there can be at most one individual that is related to the individual via the property.

3. Inverse Functional Properties:
   If a property is inverse functional then it means that the inverse property is functional. For a given individual, there can be at most one individual related to that individual via the property

4. Transitive Properties:
   If a property is transitive, and the property relates individual a to individual b, and also individual b to individual c, then we can infer that individual a is related to individual c via property P.

5. Symmetric Properties:
   If a property P is symmetric, and the property relates individual a to individual b then individual b is also related to individual a via property P.

6. Asymmetric Properties:
   If a property P is asymmetric, and the property relates individual a to individual b then individual b cannot be related to individual a via property P.

7. Reflexive properties:
   A property P is said to be reflexive when the property must relate individual a to itself.

8. Irreflexive Properties:
   If a property P is irreflexive, it can be described as a property that relates an individual a to individualb, where individual a and individualb are not the same.

## 5.3   Reasoner

One of the key features of ontologies that are described using OWL-DL is that they can be processed by a reasoner. One of the main services offered by a reasoner is to test whether or not one class is a subclass of another class.

The reasoner also enables the DL Query tab, allowing the user to execute queries on the ontology in order to find the required information.

We will exemplify that in the next chapter.

# Chapter 6

# Experiments

Using the reasoner mentioned earlier, and a DL Query, we can easily obtain information regarding some individuals or classes.

The goals of this project was to create an ontology to help online shops organize the delivery of orders, keep track of the products available and provide one easy way for clients to find what they are looking for. Some of those questions can be answered using the ontology queries.

1. Find orders within the same region and deliver the products at once:



2. Find the ordered products of by certain person:

DL query:

**Query (class expression)**

(isOrderedBy **value** Ciucescu_Vlad)

[ Execute ] [ Add to ontology ]

**Query results**

Instances (3 of 3)
- ◆ **Microsoft_Audition_As9**
- ◆ **Microsoft_LifeCam_HD-3000**
- ◆ **Microsoft_Trust_Mico**

3. Help a client find suitable products with a certain product:

DL query:

**Query (class expression)**

isRecommendedWith **value** Colorado_regular

[ Execute ] [ Add to ontology ]

**Query results**

Instances (2 of 2)
- ◆ **Casual_black**
- ◆ **Colorado_slim_fit**

# Appendix A

# Original code

```xml
<?xml version="1.0"?>
<Ontology xmlns="http://www.w3.org/2002/07/owl#"
     xml:base="http://www.semanticweb.org/acuraulm/ontologies/
     2018/0/untitled-ontology-15"
     xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
     xmlns:xml="http://www.w3.org/XML/1998/namespace"
     xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
     xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
     ontologyIRI="http://www.semanticweb.org/acuraulm/ontologies/
     2018/0/untitled-ontology-15">
  <Prefix name="" IRI="http://www.semanticweb.org/acuraulm/ontologies/
  2018/0/untitled-ontology-15#"/>
  <Prefix name="owl" IRI="http://www.w3.org/2002/07/owl#"/>
  <Prefix name="rdf" IRI="http://www.w3.org/1999/02/22-rdf-syntax-ns#"/>
  <Prefix name="xml" IRI="http://www.w3.org/XML/1998/namespace"/>
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  <Declaration>
```

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        <Class IRI="#Accessory"/>
    </Declaration>
    <Declaration>
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    </Declaration>
    <Declaration>
        <NamedIndividual IRI="#Goana_Resizeable_Leather"/>
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        <Class IRI="#Household"/>
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        <Class IRI="#Shoes"/>
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```

```xml
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</Declaration>
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    <NamedIndividual IRI="#BVLGARI_Aqva"/>
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<Declaration>
    <NamedIndividual IRI="#Nivea"/>
</Declaration>
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```

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<Declaration>
    <Class IRI="#Bracelet"/>
</Declaration>
<Declaration>
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```

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```

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        <Class IRI="#Region"/>
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    <SubClassOf>
        <Class IRI="#Town"/>
        <ObjectAllValuesFrom>
            <ObjectProperty IRI="#isWithinCounty"/>
            <Class IRI="#County"/>
        </ObjectAllValuesFrom>
    </SubClassOf>
    <SubClassOf>
        <Class IRI="#Washing_Machine"/>
        <Class IRI="#Household"/>
    </SubClassOf>
    <SubClassOf>
        <Class IRI="#Watch"/>
        <Class IRI="#Accessory"/>
    </SubClassOf>
    <DisjointClasses>
        <Class IRI="#County"/>
        <Class IRI="#Town"/>
    </DisjointClasses>
    <DisjointClasses>
        <Class IRI="#Refrigerator"/>
        <Class IRI="#Washing_Machine"/>
    </DisjointClasses>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#A4Tech"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Microphone"/>
        <NamedIndividual IRI="#A4Tech_AC-783"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Headphone"/>
        <NamedIndividual IRI="#A4Tech_MDRXB650"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Camera"/>
        <NamedIndividual IRI="#A4Tech_PK-635K"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Laptop"/>
        <NamedIndividual IRI="#ASUS_X54UA"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Laptop"/>
```

```xml
        <NamedIndividual IRI="#ASUS_X54UV"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Client"/>
        <NamedIndividual IRI="#Acu_Raul"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#Arctic"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#Asus"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#BVLGARI"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Perfume"/>
        <NamedIndividual IRI="#BVLGARI_Aqva"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Perfume"/>
        <NamedIndividual IRI="#BVLGARI_Omnia_Crystalline"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Client"/>
        <NamedIndividual IRI="#Biris_Alexandra"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Town"/>
        <NamedIndividual IRI="#Bistrita"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#County"/>
        <NamedIndividual IRI="#Bistrita_Nasaud"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Shoes"/>
        <NamedIndividual IRI="#Casual_black"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Client"/>
        <NamedIndividual IRI="#Ciucescu_Vlad"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Shoes"/>
        <NamedIndividual IRI="#Clarks_leather"/>
    </ClassAssertion>
```

```
<ClassAssertion>
    <Class IRI="#County"/>
    <NamedIndividual IRI="#Cluj"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Town"/>
    <NamedIndividual IRI="#Cluj-Napoca"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Brand"/>
    <NamedIndividual IRI="#Colorado"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Jeans"/>
    <NamedIndividual IRI="#Colorado_regular"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Shirt"/>
    <NamedIndividual IRI="#Colorado_slim_fit"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Brand"/>
    <NamedIndividual IRI="#Dove"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Brand"/>
    <NamedIndividual IRI="#Fossil"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Watch"/>
    <NamedIndividual IRI="#Fossil_Georgia_ES2830"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Watch"/>
    <NamedIndividual IRI="#Fossil_Jacqueline_ES3433"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Brand"/>
    <NamedIndividual IRI="#Goana"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Bracelet"/>
    <NamedIndividual IRI="#Goana_Natural_Leather"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Bracelet"/>
    <NamedIndividual IRI="#Goana_Resizeable_Leather"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Client"/>
```

```
        <NamedIndividual IRI="#Gog_Andrei"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#HUGO_BOSS"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Client"/>
        <NamedIndividual IRI="#Ionutas_Andreea"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#Lenovo"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Laptop"/>
        <NamedIndividual IRI="#Lenovo_IdeaPad_700-15ISK"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Laptop"/>
        <NamedIndividual IRI="#Lenovo_Legion_Y720-15IKB"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#Logitech"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Camera"/>
        <NamedIndividual IRI="#Logitech_HD_Pro-C920"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#Microsoft"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Headphone"/>
        <NamedIndividual IRI="#Microsoft_Audition_As9"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Camera"/>
        <NamedIndividual IRI="#Microsoft_LifeCam_HD-3000"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Microphone"/>
        <NamedIndividual IRI="#Microsoft_Trust_Mico"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#County"/>
        <NamedIndividual IRI="#Mures"/>
    </ClassAssertion>
```

```
<ClassAssertion>
    <Class IRI="#Client"/>
    <NamedIndividual IRI="#Muthi_Ionut"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Town"/>
    <NamedIndividual IRI="#Nasaud"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Brand"/>
    <NamedIndividual IRI="#Nielssen"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Jeans"/>
    <NamedIndividual IRI="#Nielssen_regular"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Brand"/>
    <NamedIndividual IRI="#Nivea"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Client"/>
    <NamedIndividual IRI="#Pantis_Vlad"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Brand"/>
    <NamedIndividual IRI="#Razer"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Town"/>
    <NamedIndividual IRI="#Rebrisoara"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#County"/>
    <NamedIndividual IRI="#Salaj"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Brand"/>
    <NamedIndividual IRI="#Star-Light"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Refrigerator"/>
    <NamedIndividual IRI="#Star-Light_FTTM-113AP"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Town"/>
    <NamedIndividual IRI="#Targu_Mures"/>
</ClassAssertion>
<ClassAssertion>
    <Class IRI="#Town"/>
```

```xml
        <NamedIndividual IRI="#Zalau"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Washing_Machine"/>
        <NamedIndividual IRI="#Arctic_AFD7001A+++"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Washing_Machine"/>
        <NamedIndividual IRI="#Arctic_EF5100A+"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#Jack&amp;Jones"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Shirt"/>
        <NamedIndividual IRI="#Jack&amp;Jones_black"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Brand"/>
        <NamedIndividual IRI="#L&apos;Oreal"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Shampoo"/>
        <NamedIndividual IRI="#L&apos;oreal_Absolute_Repair"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Shampoo"/>
        <NamedIndividual IRI="#L&apos;oreal_Professionnel_Nutrifier"/>
    </ClassAssertion>
    <ClassAssertion>
        <Class IRI="#Refrigerator"/>
        <NamedIndividual IRI="#Star-Light_FDDV-213A+"/>
    </ClassAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#A4Tech_AC-783"/>
        <NamedIndividual IRI="#A4Tech"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#A4Tech_MDRXB650"/>
        <NamedIndividual IRI="#A4Tech"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isRecommendedWith"/>
        <NamedIndividual IRI="#A4Tech_MDRXB650"/>
        <NamedIndividual IRI="#A4Tech_PK-635K"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
```

```
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#A4Tech_PK-635K"/>
        <NamedIndividual IRI="#A4Tech"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#ASUS_X54UA"/>
        <NamedIndividual IRI="#Asus"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#ASUS_X54UV"/>
        <NamedIndividual IRI="#Asus"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#livesInTown"/>
        <NamedIndividual IRI="#Acu_Raul"/>
        <NamedIndividual IRI="#Rebrisoara"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#BVLGARI_Aqva"/>
        <NamedIndividual IRI="#BVLGARI"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#BVLGARI_Omnia_Crystalline"/>
        <NamedIndividual IRI="#BVLGARI"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#livesInTown"/>
        <NamedIndividual IRI="#Biris_Alexandra"/>
        <NamedIndividual IRI="#Targu_Mures"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isWithinCounty"/>
        <NamedIndividual IRI="#Bistrita"/>
        <NamedIndividual IRI="#Bistrita_Nasaud"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#holdsTown"/>
        <NamedIndividual IRI="#Bistrita_Nasaud"/>
        <NamedIndividual IRI="#Rebrisoara"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Casual_black"/>
        <NamedIndividual IRI="#Nielssen"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
```

```
        <ObjectProperty IRI="#livesInTown"/>
        <NamedIndividual IRI="#Ciucescu_Vlad"/>
        <NamedIndividual IRI="#Cluj-Napoca"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Clarks_leather"/>
        <NamedIndividual IRI="#Colorado"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#holdsTown"/>
        <NamedIndividual IRI="#Cluj"/>
        <NamedIndividual IRI="#Cluj-Napoca"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Colorado_regular"/>
        <NamedIndividual IRI="#Colorado"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isRecommendedWith"/>
        <NamedIndividual IRI="#Colorado_regular"/>
        <NamedIndividual IRI="#Casual_black"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isRecommendedWith"/>
        <NamedIndividual IRI="#Colorado_regular"/>
        <NamedIndividual IRI="#Colorado_slim_fit"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Colorado_slim_fit"/>
        <NamedIndividual IRI="#Colorado"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isOrderedBy"/>
        <NamedIndividual IRI="#Fossil_Georgia_ES2830"/>
        <NamedIndividual IRI="#Gog_Andrei"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Fossil_Georgia_ES2830"/>
        <NamedIndividual IRI="#Fossil"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Fossil_Jacqueline_ES3433"/>
        <NamedIndividual IRI="#Fossil"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
```

```
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Goana_Natural_Leather"/>
        <NamedIndividual IRI="#Goana"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Goana_Resizeable_Leather"/>
        <NamedIndividual IRI="#Goana"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#livesInTown"/>
        <NamedIndividual IRI="#Gog_Andrei"/>
        <NamedIndividual IRI="#Cluj-Napoca"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#livesInTown"/>
        <NamedIndividual IRI="#Ionutas_Andreea"/>
        <NamedIndividual IRI="#Zalau"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Lenovo_IdeaPad_700-15ISK"/>
        <NamedIndividual IRI="#Lenovo"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Lenovo_Legion_Y720-15IKB"/>
        <NamedIndividual IRI="#Lenovo"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Logitech_HD_Pro-C920"/>
        <NamedIndividual IRI="#Logitech"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#isOrderedBy"/>
        <NamedIndividual IRI="#Microsoft_Audition_As9"/>
        <NamedIndividual IRI="#Ciucescu_Vlad"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Microsoft_Audition_As9"/>
        <NamedIndividual IRI="#Microsoft"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
        <ObjectProperty IRI="#isOrderedBy"/>
        <NamedIndividual IRI="#Microsoft_LifeCam_HD-3000"/>
        <NamedIndividual IRI="#Ciucescu_Vlad"/>
</ObjectPropertyAssertion>
<ObjectPropertyAssertion>
```

```
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Microsoft_LifeCam_HD-3000"/>
        <NamedIndividual IRI="#Microsoft"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isRecommendedWith"/>
        <NamedIndividual IRI="#Microsoft_LifeCam_HD-3000"/>
        <NamedIndividual IRI="#Microsoft_Trust_Mico"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isOrderedBy"/>
        <NamedIndividual IRI="#Microsoft_Trust_Mico"/>
        <NamedIndividual IRI="#Ciucescu_Vlad"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Microsoft_Trust_Mico"/>
        <NamedIndividual IRI="#Microsoft"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#holdsTown"/>
        <NamedIndividual IRI="#Mures"/>
        <NamedIndividual IRI="#Targu_Mures"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#livesInTown"/>
        <NamedIndividual IRI="#Muthi_Ionut"/>
        <NamedIndividual IRI="#Rebrisoara"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isWithinCounty"/>
        <NamedIndividual IRI="#Nasaud"/>
        <NamedIndividual IRI="#Bistrita_Nasaud"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#isProducedBy"/>
        <NamedIndividual IRI="#Nielssen_regular"/>
        <NamedIndividual IRI="#Nielssen"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#livesInTown"/>
        <NamedIndividual IRI="#Pantis_Vlad"/>
        <NamedIndividual IRI="#Cluj-Napoca"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
        <ObjectProperty IRI="#holdsTown"/>
        <NamedIndividual IRI="#Salaj"/>
        <NamedIndividual IRI="#Zalau"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
```

```
            <ObjectProperty IRI="#isProducedBy"/>
            <NamedIndividual IRI="#Star-Light_FTTM-113AP"/>
            <NamedIndividual IRI="#Star-Light"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
            <ObjectProperty IRI="#isProducedBy"/>
            <NamedIndividual IRI="#Arctic_AFD7001A+++"/>
            <NamedIndividual IRI="#Arctic"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
            <ObjectProperty IRI="#isProducedBy"/>
            <NamedIndividual IRI="#Arctic_EF5100A+"/>
            <NamedIndividual IRI="#Arctic"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
            <ObjectProperty IRI="#isProducedBy"/>
            <NamedIndividual IRI="#Jack&amp;Jones_black"/>
            <NamedIndividual IRI="#Jack&amp;Jones"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
            <ObjectProperty IRI="#isProducedBy"/>
            <NamedIndividual IRI="#L&apos;oreal_Absolute_Repair"/>
            <NamedIndividual IRI="#L&apos;Oreal"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
            <ObjectProperty IRI="#isProducedBy"/>
            <NamedIndividual IRI="#L&apos;oreal_Professionnel_Nutrifier"/>
            <NamedIndividual IRI="#L&apos;Oreal"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
            <ObjectProperty IRI="#isOrderedBy"/>
            <NamedIndividual IRI="#Star-Light_FDDV-213A+"/>
            <NamedIndividual IRI="#Gog_Andrei"/>
    </ObjectPropertyAssertion>
    <ObjectPropertyAssertion>
            <ObjectProperty IRI="#isProducedBy"/>
            <NamedIndividual IRI="#Star-Light_FDDV-213A+"/>
            <NamedIndividual IRI="#Star-Light"/>
    </ObjectPropertyAssertion>
    <DataPropertyAssertion>
            <DataProperty IRI="#hasPrice"/>
            <NamedIndividual IRI="#A4Tech_AC-783"/>
            <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">43.22</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
            <DataProperty IRI="#hasPrice"/>
            <NamedIndividual IRI="#A4Tech_MDRXB650"/>
            <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">124.77</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
```

```xml
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#A4Tech_PK-635K"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">89.99</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#ASUS_X54UA"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">1653.22</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#ASUS_X54UV"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">1699.99</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#isAged"/>
        <NamedIndividual IRI="#Acu_Raul"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#int">20</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#BVLGARI_Aqva"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">349.99</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#BVLGARI_Omnia_Crystalline"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">224.99</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#isAged"/>
        <NamedIndividual IRI="#Biris_Alexandra"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#int">21</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Casual_black"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">129.99</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#isAged"/>
        <NamedIndividual IRI="#Ciucescu_Vlad"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#int">20</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Clarks_leather"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">78.99</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
```

```
    <DataProperty IRI="#hasPrice"/>
    <NamedIndividual IRI="#Colorado_regular"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">15.99</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#hasPrice"/>
    <NamedIndividual IRI="#Colorado_slim_fit"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">49.99</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#hasPrice"/>
    <NamedIndividual IRI="#Fossil_Georgia_ES2830"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">365.55</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#hasPrice"/>
    <NamedIndividual IRI="#Fossil_Jacqueline_ES3433"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">129.55</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#hasPrice"/>
    <NamedIndividual IRI="#Goana_Natural_Leather"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">43.99</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#hasPrice"/>
    <NamedIndividual IRI="#Goana_Resizeable_Leather"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">49.99</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#isAged"/>
    <NamedIndividual IRI="#Gog_Andrei"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#int">21</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#isAged"/>
    <NamedIndividual IRI="#Ionutas_Andreea"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#int">21</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#hasPrice"/>
    <NamedIndividual IRI="#Lenovo_IdeaPad_700-15ISK"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">4321.21</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
    <DataProperty IRI="#hasPrice"/>
    <NamedIndividual IRI="#Lenovo_Legion_Y720-15IKB"/>
    <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">6389.99</Literal>
</DataPropertyAssertion>
<DataPropertyAssertion>
```

```
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Logitech_HD_Pro-C920"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">67.97</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Microsoft_Audition_As9"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">133.89</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Microsoft_LifeCam_HD-3000"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">55.56</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Microsoft_Trust_Mico"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">25.98</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#isAged"/>
        <NamedIndividual IRI="#Muthi_Ionut"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#int">20</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Nielssen_regular"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">40.55</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#isAged"/>
        <NamedIndividual IRI="#Pantis_Vlad"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#int">21</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Star-Light_FTTM-113AP"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">565.78</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Jack&amp;Jones_black"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">60.99</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#L&apos;oreal_Absolute_Repair"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">79.99</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
```

```xml
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#L&apos;oreal_Professionnel_Nutrifier"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">35.25</Literal>
    </DataPropertyAssertion>
    <DataPropertyAssertion>
        <DataProperty IRI="#hasPrice"/>
        <NamedIndividual IRI="#Star-Light_FDDV-213A+"/>
        <Literal datatypeIRI="http://www.w3.org/2001/XMLSchema#float">765.43</Literal>
    </DataPropertyAssertion>
    <SubObjectPropertyOf>
        <ObjectProperty IRI="#ordered"/>
        <ObjectProperty abbreviatedIRI="owl:topObjectProperty"/>
    </SubObjectPropertyOf>
    <InverseObjectProperties>
        <ObjectProperty IRI="#holdsTown"/>
        <ObjectProperty IRI="#isWithinCounty"/>
    </InverseObjectProperties>
    <InverseObjectProperties>
        <ObjectProperty IRI="#isOrderedBy"/>
        <ObjectProperty IRI="#ordered"/>
    </InverseObjectProperties>
    <InverseObjectProperties>
        <ObjectProperty IRI="#isProducedBy"/>
        <ObjectProperty IRI="#produces"/>
    </InverseObjectProperties>
    <FunctionalObjectProperty>
        <ObjectProperty IRI="#isProducedBy"/>
    </FunctionalObjectProperty>
    <FunctionalObjectProperty>
        <ObjectProperty IRI="#isWithinCounty"/>
    </FunctionalObjectProperty>
    <FunctionalObjectProperty>
        <ObjectProperty IRI="#livesInTown"/>
    </FunctionalObjectProperty>
    <InverseFunctionalObjectProperty>
        <ObjectProperty IRI="#holdsTown"/>
    </InverseFunctionalObjectProperty>
    <InverseFunctionalObjectProperty>
        <ObjectProperty IRI="#produces"/>
    </InverseFunctionalObjectProperty>
    <SymmetricObjectProperty>
        <ObjectProperty IRI="#isRecommendedWith"/>
    </SymmetricObjectProperty>
    <ObjectPropertyDomain>
        <ObjectProperty IRI="#holdsTown"/>
        <Class IRI="#County"/>
    </ObjectPropertyDomain>
    <ObjectPropertyDomain>
        <ObjectProperty IRI="#isOrderedBy"/>
        <Class IRI="#Product"/>
```

```xml
    </ObjectPropertyDomain>
    <ObjectPropertyDomain>
        <ObjectProperty IRI="#isProducedBy"/>
        <Class IRI="#Product"/>
    </ObjectPropertyDomain>
    <ObjectPropertyDomain>
        <ObjectProperty IRI="#isRecommendedWith"/>
        <Class IRI="#Product"/>
    </ObjectPropertyDomain>
    <ObjectPropertyDomain>
        <ObjectProperty IRI="#isWithinCounty"/>
        <Class IRI="#Town"/>
    </ObjectPropertyDomain>
    <ObjectPropertyDomain>
        <ObjectProperty IRI="#livesInTown"/>
        <Class IRI="#Client"/>
    </ObjectPropertyDomain>
    <ObjectPropertyDomain>
        <ObjectProperty IRI="#ordered"/>
        <Class IRI="#Product"/>
    </ObjectPropertyDomain>
    <ObjectPropertyDomain>
        <ObjectProperty IRI="#produces"/>
        <Class IRI="#Brand"/>
    </ObjectPropertyDomain>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#holdsTown"/>
        <Class IRI="#Town"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#isOrderedBy"/>
        <Class IRI="#Client"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#isProducedBy"/>
        <Class IRI="#Brand"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#isRecommendedWith"/>
        <Class IRI="#Product"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#isWithinCounty"/>
        <Class IRI="#County"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#livesInTown"/>
        <Class IRI="#Town"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
```

```
        <ObjectProperty IRI="#ordered"/>
        <Class IRI="#Client"/>
    </ObjectPropertyRange>
    <ObjectPropertyRange>
        <ObjectProperty IRI="#produces"/>
        <Class IRI="#Product"/>
    </ObjectPropertyRange>
    <DisjointObjectProperties>
        <ObjectProperty IRI="#holdsTown"/>
        <ObjectProperty IRI="#isOrderedBy"/>
        <ObjectProperty IRI="#isProducedBy"/>
        <ObjectProperty IRI="#isRecommendedWith"/>
        <ObjectProperty IRI="#isWithinCounty"/>
        <ObjectProperty IRI="#livesInTown"/>
        <ObjectProperty IRI="#produces"/>
    </DisjointObjectProperties>
    <SubDataPropertyOf>
        <DataProperty IRI="#hasPrice"/>
        <DataProperty abbreviatedIRI="owl:topDataProperty"/>
    </SubDataPropertyOf>
    <SubDataPropertyOf>
        <DataProperty IRI="#isAged"/>
        <DataProperty abbreviatedIRI="owl:topDataProperty"/>
    </SubDataPropertyOf>
    <DataPropertyDomain>
        <DataProperty IRI="#hasPrice"/>
        <Class IRI="#Product"/>
    </DataPropertyDomain>
    <DataPropertyDomain>
        <DataProperty IRI="#isAged"/>
        <Class IRI="#Client"/>
    </DataPropertyDomain>
    <DataPropertyRange>
        <DataProperty IRI="#hasPrice"/>
        <Datatype abbreviatedIRI="xsd:float"/>
    </DataPropertyRange>
    <DataPropertyRange>
        <DataProperty IRI="#isAged"/>
        <Datatype abbreviatedIRI="xsd:int"/>
    </DataPropertyRange>
    <AnnotationAssertion>
        <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
        <IRI>#livesInTown</IRI>
        <Literal xml:lang="en" datatypeIRI="http://www.w3.org/1999/02/22-rdf-syntax-ns#P
    </AnnotationAssertion>
</Ontology>
```