

Programming Assignment 3: Building an OWL Ontology

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Question 1

Do any of your classes come out as inconsistent? (They will be shown in red in the Class hierarchy tab; you may need to expand to see the red.) Explain why and describe a way to resolve the inconsistency.

Answer:

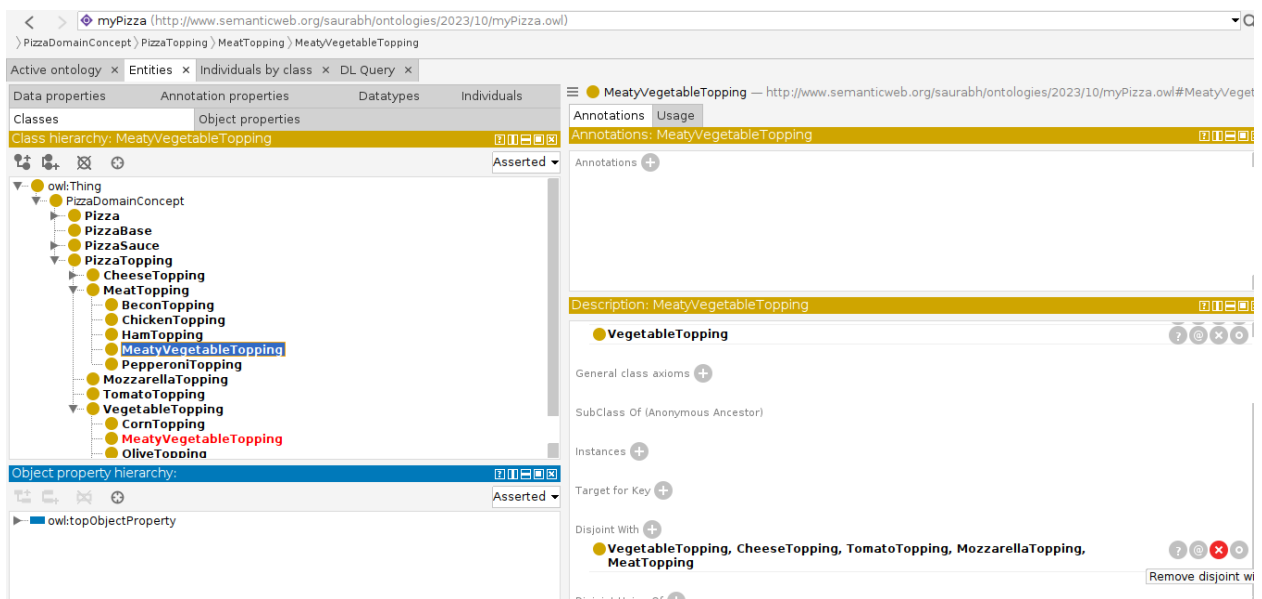
Yes, "MeatyVegetableTopping" class comes out as inconsistent. When we added the "MeatyVegetableTopping" and linked it to both the "MeatTopping" and "VegetableTopping" classes, we noticed a lack of consistency in the classes. This occurs because a single topping shouldn't be assigned to two distinct topping categories.

The screenshot displays the Protégé OWL editor interface for the ontology 'myPizza' (http://www.semanticweb.org/saurabh/ontologies/2023/10/myPizza.owl). The main window shows the 'Class hierarchy' tab, where the class hierarchy is visualized. The hierarchy starts with 'owl:Thing' at the root, followed by 'PizzaDomainConcept', 'Pizza', 'NamedPizza', 'PizzaBase', 'PizzaTopping', 'CheeseTopping', 'MeatTopping', 'MeatyVegetableTopping', 'MozzarellaTopping', 'TomatoTopping', 'VegetableTopping', and 'MeatyVegetableTopping'. The 'MeatyVegetableTopping' class is highlighted in red, indicating it is inconsistent. The right pane shows the 'Annotations' tab for 'MeatyVegetableTopping', which is currently empty. The 'Description' tab shows 'MeatyVegetableTopping' as 'owl:Nothing'. The 'SubClass Of' tab shows 'MeatyVegetableTopping' as a subclass of 'MeatTopping' and 'VegetableTopping'. The 'General class axioms' tab shows 'MeatyVegetableTopping' as a subclass of 'MeatTopping' and 'VegetableTopping'. The 'Instances' tab shows 'MeatyVegetableTopping' as an instance of 'MeatTopping' and 'VegetableTopping'. The 'Target for Key' tab shows 'MeatyVegetableTopping' as a target for a key.

Explanation of inconsistency

There are 2 possible points for it. (Refer below image)

1. "MeatyVegetableTopping" has two parent classes, named "MeatTopping" and "VegetableTopping." If you examine the "Disjoint With +" property (in "Description View") of both classes, you would notice the occurrence of another parent. In the "Disjoint With +" property of "MeatTopping," you would see "VegetableTopping," and vice versa. This causes inconsistency.
2. The issue can still persist if you examine all subclasses of "PizzaTopping" in the "Disjoint With +" of "MeatyVegetableTopping." The possible cause of this issue is when you perform the following steps in the specified order:
 - a. Create "MeatTopping" and "VegetableTopping" classes first.
 - b. Add the "disjoint with +" property for all subclasses of "PizzaTopping" for both of them.
 - c. Create "MeatyVegetableTopping" as a subclass of "MeatTopping" or "VegetableTopping."
"MeatyVegetableTopping" will copy all properties of the superclass.



Way to resolve the inconsistency

1. Remove “VegetableTopping” from “Disjoint With +” of the “MeatTopping” class or vice versa.
Remove dependency from each other.
2. Remove all classes (which shows inconsistency with meat or veg class) from “Disjoint With +” of the “MeatVegetableTopping” class.

The screenshot shows the Protégé ontology editor for the `myPizza` ontology. The left pane displays the class hierarchy, with `VegetableTopping` highlighted. The right pane shows the details for `VegetableTopping`, including its URI, annotations, and a list of disjoint classes: `CheeseTopping`, `TomatoTopping`, and `MozzarellaTopping`.

Active ontology: `myPizza` (<http://www.semanticweb.org/saurabh/ontologies/2023/10/myPizza.owl>)

Classes: `VegetableTopping`

Class hierarchy: `VegetableTopping`

- `Pizza`
 - `PizzaBase`
 - `PizzaSauce`
 - `PizzaTopping`
 - `CheeseTopping`
 - `MeatTopping`
 - `BeconTopping`
 - `ChickenTopping`
 - `HamTopping`
 - `MeatyVegetableTopping`
 - `PepperoniTopping`
 - `MozzarellaTopping`
 - `TomatoTopping`
 - `VegetableTopping`
 - `CornTopping`
 - `MeatyVegetableTopping`
 - `OliveTopping`
 - `PaneerTopping`
 - `zucchiniTopping`

Object property hierarchy: `owl:topObjectProperty`

Details for `VegetableTopping` (<http://www.semanticweb.org/saurabh/ontologies/2023/10/myPizza.owl#VegetableTopping>):

- Annotations: `VegetableTopping`
- Description: `VegetableTopping`
- SubClass Of: `PizzaTopping`
- General class axioms: +
- SubClass Of (Anonymous Ancestor):
- Instances: +
- Target for Key: +
- Disjoint With: `CheeseTopping`, `TomatoTopping`, `MozzarellaTopping`

Question 6

Q6. First query of your own choice.

>>> "NamedPizza and VegPizza"

Q6-1. Explanation of the First query.

This query finds all the pizza defined by me (in NamedPizza class) having vegetable options only. This query is equivalent of which equivalent to "NamedPizza and Pizza and (hasTopping some VegetableTopping)"

Q6-2. Screenshot of the First query.

The screenshot displays the myPizza ontology editor interface. The top navigation bar shows the active ontology as `myPizza` (http://www.semanticweb.org/saurabh/ontologies/2023/10/myPizza.owl). Below this, the breadcrumb path is `PizzaDomainConcept > Pizza`. The main interface is divided into two panes. The left pane, titled "Class hierarchy: Pizza", shows a tree structure of classes. The root is `owl:Thing`, which has a child `PizzaDomainConcept`. `PizzaDomainConcept` has a child `Pizza`. `Pizza` has two children: `MeatyPizza` and `VegPizza`. `MeatyPizza` has several children: `AmericanPizza`, `BarbequeChickenPizza`, `FarmhousePizza`, `MargheritaPizza`, `PaneerMakhaniPizza`, and `SohoPizza`. `VegPizza` has three children: `PizzaBase`, `PizzaNationality`, and `PizzaOil`. `PizzaNationality` has three children: `American`, `Indian`, and `Italian`. `PizzaOil` has three children: `PizzaSauce`, `PizzaSize`, and `PizzaTopping`. `PizzaTopping` has three children: `CheeseTopping`, `MeatTopping`, and `VegetableTopping`. The right pane, titled "DL query:", contains a text input field with the query `NamedPizza and VegPizza`. Below the input field are two buttons: "Execute" and "Add to ontology". Below the buttons is a section titled "Query results" which displays two lists. The first list, "Superclasses (4 of 5)", contains `NamedPizza`, `Pizza`, `PizzaDomainConcept`, and `VegPizza`. The second list, "Subclasses (3 of 4)", contains `FarmhousePizza`, `MargheritaPizza`, and `PaneerMakhaniPizza`.

Question 7

Q7. Second query of your own choice.

```
>>> "VegPizza and hasNationality some Indian and hasOil some NoOil"
```

Q7-1. Explanation of the Second query.

This query is for vegetarian Indians who do not like oil in their food. This returns Vegetable Pizza having Indian nationality with No Oil in pizza.

Q7-2. Screenshot of the Second query.

myPizza (http://www.semanticweb.org/saurabh/ontologies/2023/10/myPizza.owl)

PizzaDomainConcept > Pizza

Active ontology x Entities x Individuals by class x DL Query x

Class hierarchy: Pizza DL query:

Query (class expression)

VegPizza and hasNationality some Indian and hasOil some NoOil

Execute Add to ontology

Query results

Superclasses (3 of 4)

- Pizza
- PizzaDomainConcept
- VegPizza

Subclasses (2 of 3)

- FarmhousePizza
- PaneerMakhaniPizza

Q2-Add two more pizzas.

1. Paneer Makhani Pizza
 2. Barbeque Chicken Pizza
-

Q3-Add two more PizzaBase.

1. Neapolitan Dough Base
 2. Multigrain Dough Base
-

Q4-Add two more PizzaTopping.

1. Chicken Topping
 2. Olive Topping
-

Q5-Add at least four more properties.

1. Pizza Sauce
 2. Pizza Size
 3. Pizza Nationality
 4. Pizza Oil
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