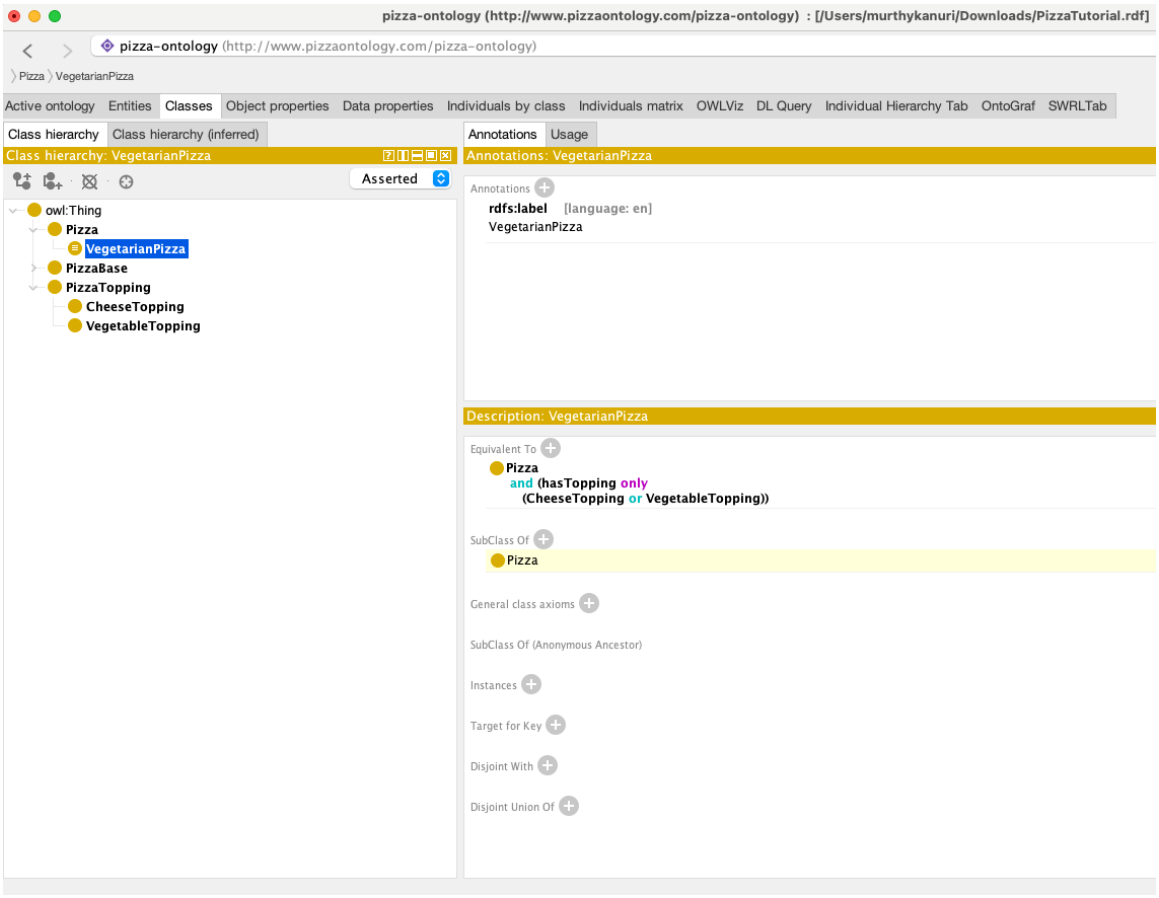
Knowledge Representation and Reasoning

Unit 10: Reasoning with Protégé

Formative Activities

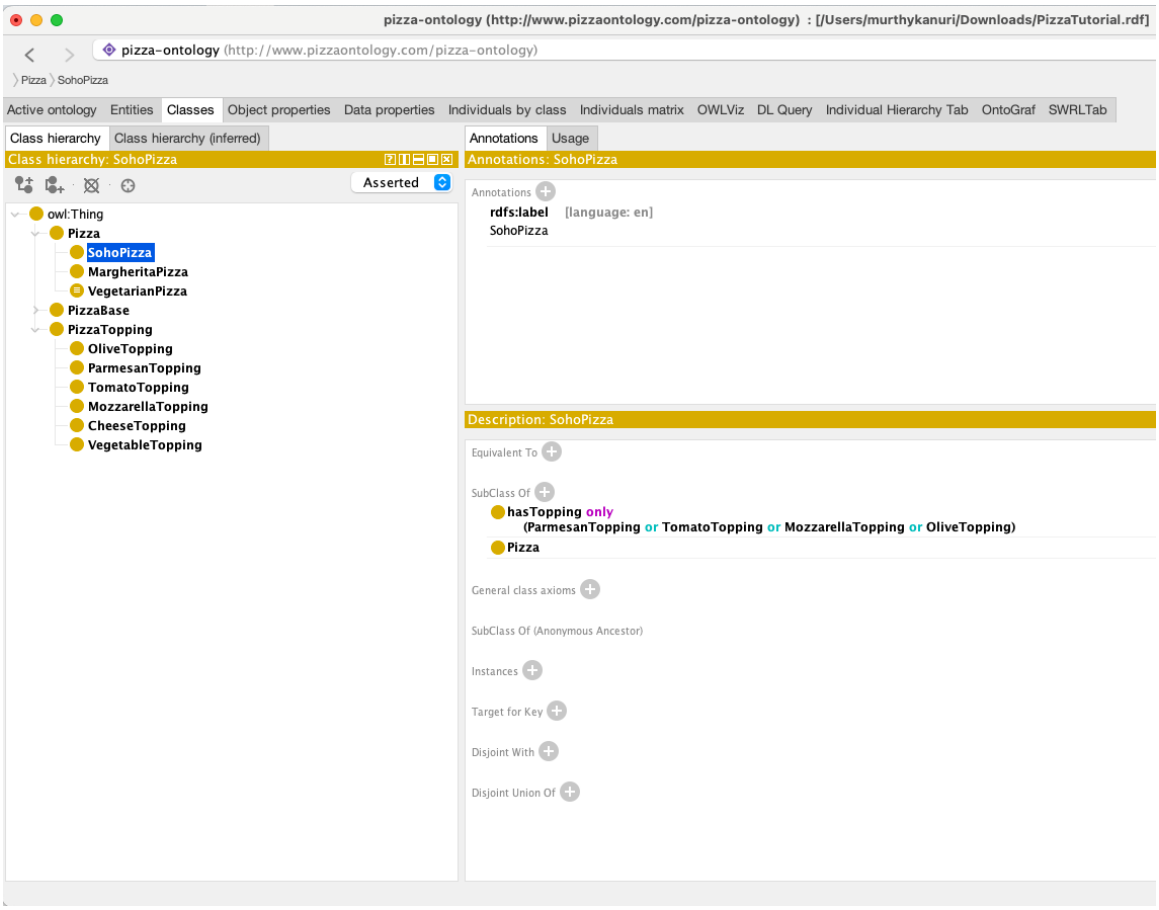
Exercise 22: Create a Defined Class called VegetarianPizza

- Select the Pizza in the Classes tab. Create a subclass of Pizza and name it VegetarianPizza.
- Make sure VegetarianPizza is selected. Click on the Add icon (+) next to the SubClass Of field in the
- Description view.
- Select the Class expression editor tab from the pop-up window. Type in the Description Logic axiom:
- hasTopping only (VegetableTopping or CheeseTopping). Click on OK.
- Make sure VegetarianPizza is still selected. Run the Edit>Convert to defined class command.
- VegetarianPizza should now have three horizontal lines through it just as CheesyPizza does.
- Also, the Equivalent To field in the Description view should have: Pizza and (hasTopping only
- (CheeseTopping or VegetableTopping)). Note that another way to create defined classes is to enter the
- Description Logic axiom directly into the Equivalent To field.
- Synchronize the reasoner.


pizza-ontology (http://www.pizzaontology.com/pizza-ontology) : [/Users/murthykanuri/Downloads/PizzaTutorial.rdf]
pizza-ontology (http://www.pizzaontology.com/pizza-ontology)
Pizza
VegetarianPizza
Active ontology
Entities
Classes
Object properties
Data properties
Individuals by class
Individuals matrix
OWLViz
DL Query
Individual Hierarchy Tab
OntoGraf
SWRLTab
Class hierarchy
Class hierarchy (inferred)
Class hierarchy: VegetarianPizza
Asserted
owl:Thing
Pizza
VegetarianPizza
PizzaBase
PizzaTopping
CheeseTopping
VegetableTopping
Annotations
Usage
Annotations: VegetarianPizza
Annotations
rdfs:label [language: en]
VegetarianPizza
Description: VegetarianPizza
Equivalent To
Pizza
and (hasTopping only
(CheeseTopping or VegetableTopping))
SubClass Of
Pizza
General class axioms
SubClass Of (Anonymous Ancestor)
Instances
Target for Key
Disjoint With
Disjoint Union Of

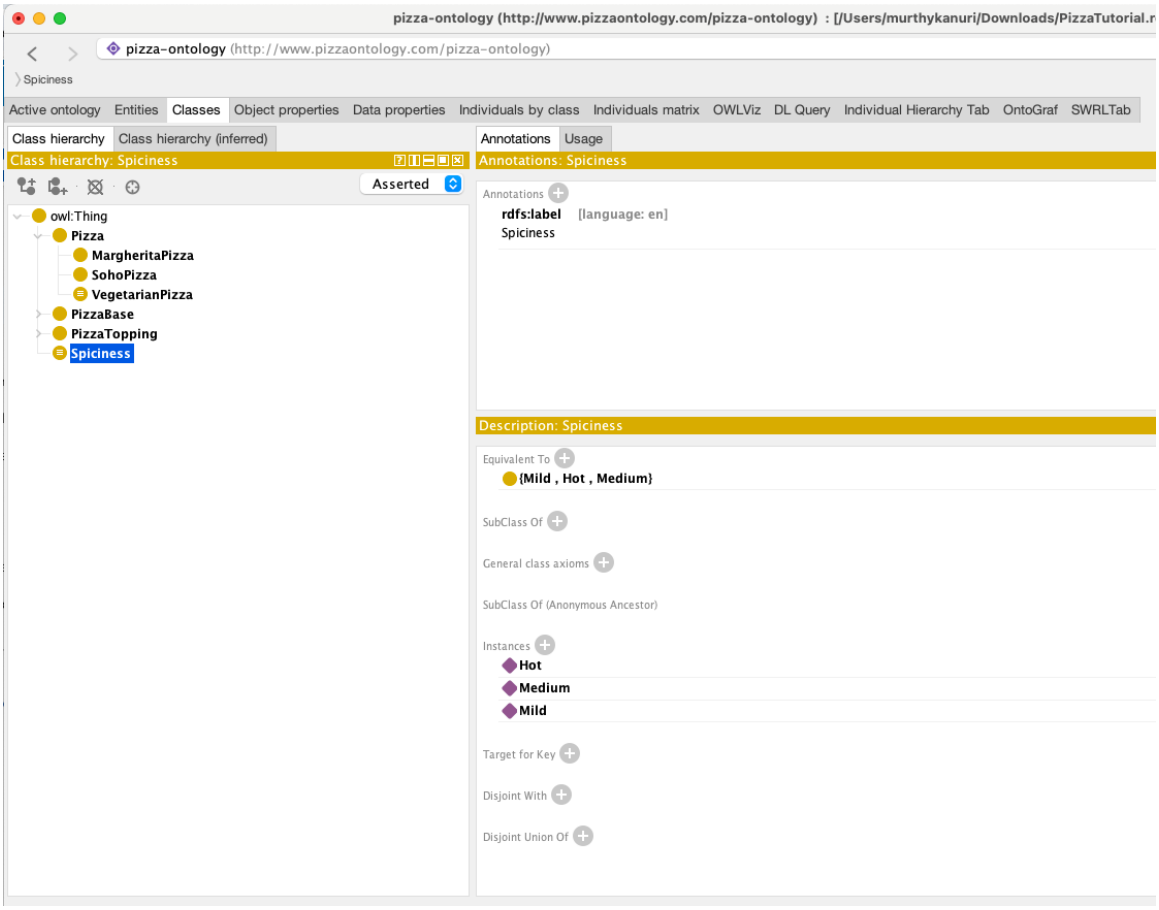
Exercise 23: Add a Closure Axiom on the hasTopping Property for MargheritaPizza

- Make sure that MargheritaPizza is selected in the class hierarchy in the Classes tab.
- Click on the Add icon (+) next to the SubClass Of field in the Description view.
- Select the Class expression editor tab from the pop-up window. Type in the Description Logic axiom: hasTopping only (MozzarellaTopping or TomatoTopping).
- Click on OK.
- Repeat steps 1-4 but this time click on SohoPizza and use the axiom: hasTopping only (MozzarellaTopping or TomatoTopping or ParmesanTopping or OliveTopping).
- Synchronize the reasoner.



Exercise 24: Create an Enumerated Class to Represent the Spiciness of a Pizza

- Create a new subclass of owl:Thing called Spiciness.
- Make sure that Spiciness is selected. Click on the Add icon (+) next to the Instances field in the Description view.
- You will be prompted with a window that looks like figure 4.24. The diamond icon at the top is for creating a new individual. The circle with an X through it is for deleting an individual. Use the diamond icon to create 3 individuals: Hot, Medium, and Mild, so your UI looks like figure 4.24, then click on OK.
- You may notice that only one of the new individuals was actually created as an instance of Spiciness. That's okay. The next step will supply the reasoner with enough information to make the other two also be instances of Spiciness.
- Make sure that Spiciness is still selected. Click on the Add icon (+) next to the Equivalent To field in the Description view. This time we will create a defined class by directly entering the definition for the class into this field. Select the Class expression editor tab and enter the DL axiom: {Hot, Medium, Mild}.
- Select OK.
- Now run the reasoner. You should see that Spiciness is now a defined class and all three individuals: Hot, Medium, and Mild, are now instances of that class.

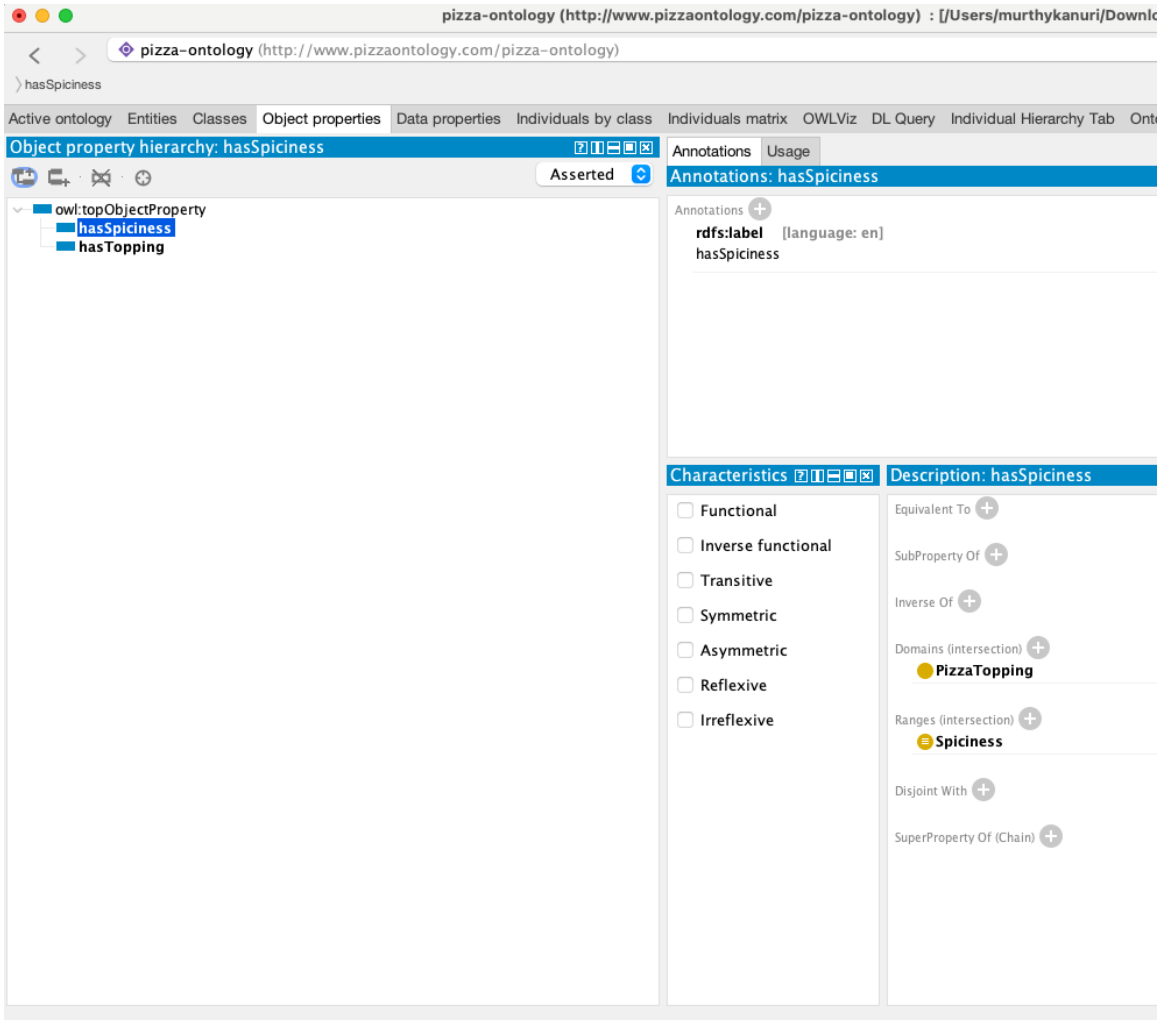


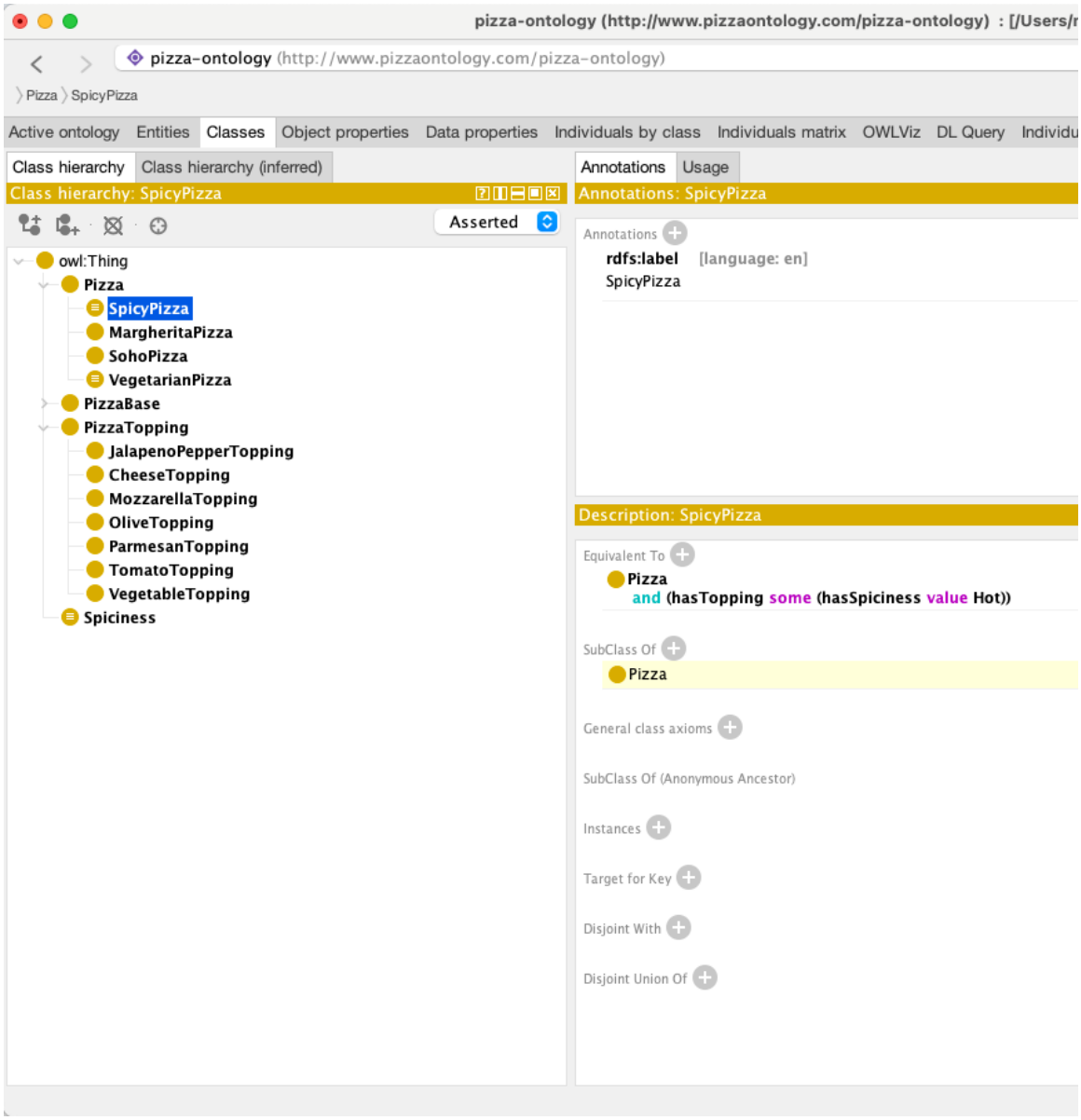
Exercise 25: Create and Use the hasSpiciness Property

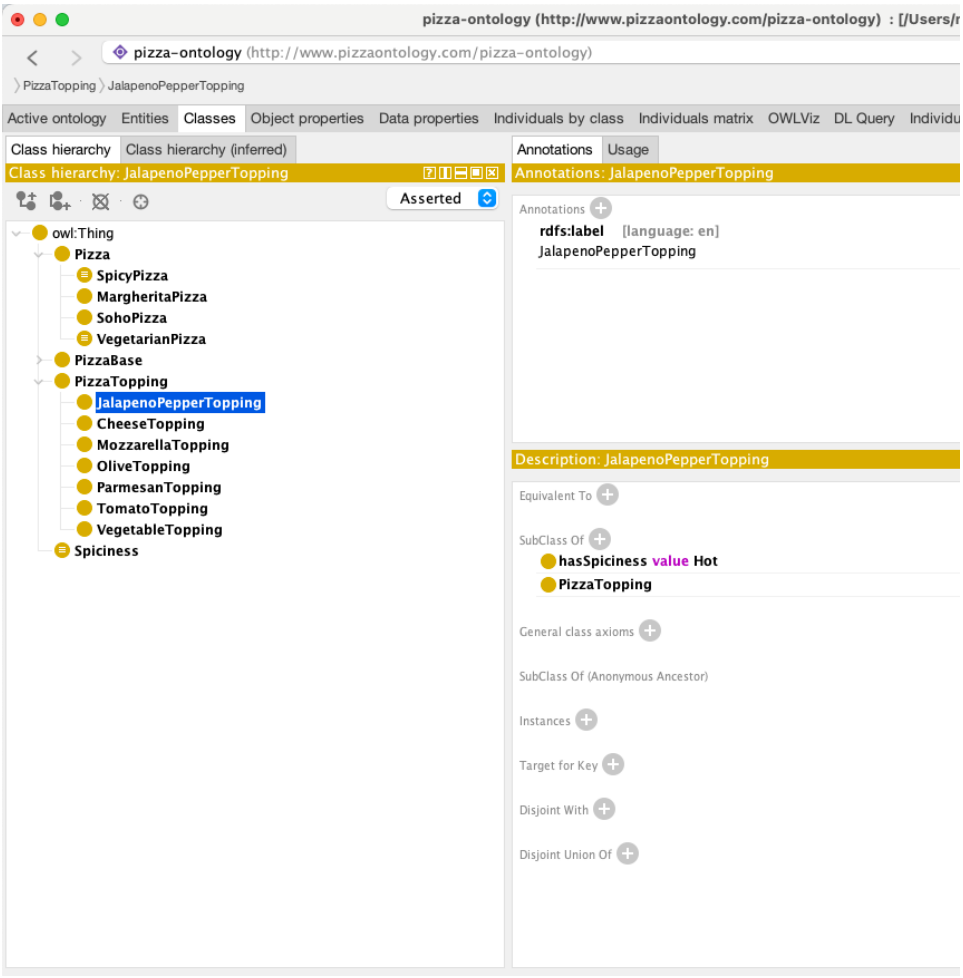
- Go to the Object properties tab. Create a new property called hasSpiciness. Define its domain to be
- PizzaTopping and its range to be Spiciness. Run the reasoner so that it knows about the new property.
- Go back to the Classes tab and select the class JalapenoPepperTopping. Click on the Add icon (+) next to the SubClass Of field. Enter the DL axiom: hasSpiciness value Hot. Remember you can use <control><space> to auto-complete. Click on OK.
- Note that this is a different kind of restriction than before. Before we were defining abstract restrictions such as some. I.e., some value from a class but the specific individual was not

specified, as long as it was an individual from that class the restriction was satisfied. Now we are defining a restriction that relates to a specific individual, hence we use the value keyword rather than the some or only keywords.

- Now we will use this property to define a new class of Pizza. Start by creating a new subclass of Pizza called SpicyPizza.
- Make sure that SpicyPizza is selected. Click on the Add icon (+) next to the SubClass Of field. Enter the DL axiom: hasTopping some (hasSpiciness value Hot). This says that a SpicyPizza must have a topping that hasSpiciness value of Hot.
- Convert SpicyPizza to a defined class by selecting it and using Edit>Convert to defined class. Run the reasoner.

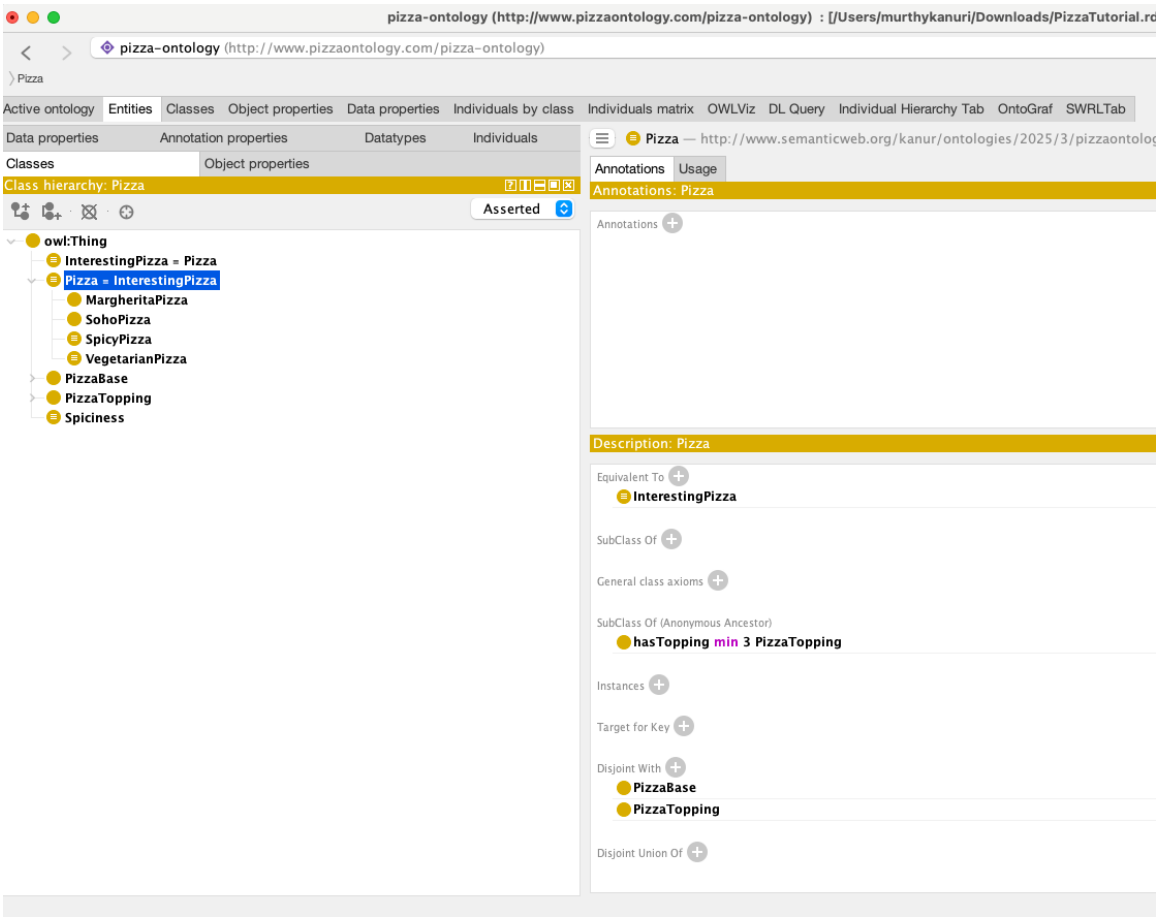

pizza-ontology (http://www.pizzaontology.com/pizza-ontology) : [/Users/murthykanuri/Downlo
pizza-ontology (http://www.pizzaontology.com/pizza-ontology)
hasSpiciness
Active ontology
Entities
Classes
Object properties
Data properties
Individuals by class
Individuals matrix
OWLViz
DL Query
Individual Hierarchy Tab
Object property hierarchy: hasSpiciness
Asserted
owl:topObjectProperty
hasSpiciness
hasTopping
Annotations
Usage
Annotations: hasSpiciness
Annotations
rdfs:label [language: en]
hasSpiciness
Characteristics
Functional
Inverse functional
Transitive
Symmetric
Asymmetric
Reflexive
Irreflexive
Description: hasSpiciness
Equivalent To
SubProperty Of
Inverse Of
Domains (intersection)
PizzaTopping
Ranges (intersection)
Spiciness
Disjoint With
SuperProperty Of (Chain)


pizza-ontology (http://www.pizzaontology.com/pizza-ontology) : [/Users/r
pizza-ontology (http://www.pizzaontology.com/pizza-ontology)
Pizza
SpicyPizza
Active ontology
Entities
Classes
Object properties
Data properties
Individuals by class
Individuals matrix
OWLViz
DL Query
Individu
Class hierarchy
Class hierarchy (inferred)
Class hierarchy: SpicyPizza
Asserted
owl:Thing
Pizza
SpicyPizza
MargheritaPizza
SohoPizza
VegetarianPizza
PizzaBase
PizzaTopping
JalapenoPepperTopping
CheeseTopping
MozzarellaTopping
OliveTopping
ParmesanTopping
TomatoTopping
VegetableTopping
Spiciness
Annotations
Usage
Annotations: SpicyPizza
Annotations
rdfs:label
[language: en]
SpicyPizza
Description: SpicyPizza
Equivalent To
Pizza
and (hasTopping some (hasSpiciness value Hot))
SubClass Of
Pizza
General class axioms
SubClass Of (Anonymous Ancestor)
Instances
Target for Key
Disjoint With
Disjoint Union Of



Exercise 26: Create an InterestingPizza that has at least three toppings

- Create a subclass of Pizza called InterestingPizza.
- Click on the Add icon (+) next to the SubClass Of field. Use the Class expression editor tab and enter hasTopping min 3 PizzaTopping and click on OK.
- Make sure InterestingPizza is still selected and use the Edit>Convert to defined class option to turn
- InterestingPizza into a defined class.
- 4. Run the reasoner.


pizza-ontology (http://www.pizzaontology.com/pizza-ontology) : [/Users/murthykanuri/Downloads/PizzaTutorial.rd
pizza-ontology (http://www.pizzaontology.com/pizza-ontology)
Pizza
Active ontology
Entities
Classes
Object properties
Data properties
Individuals by class
Individuals matrix
OWLViz
DL Query
Individual Hierarchy Tab
OntoGraf
SWRLTab
Data properties
Annotation properties
Datatypes
Individuals
Classes
Object properties
Class hierarchy: Pizza
Asserted
owl:Thing
InterestingPizza = Pizza
Pizza = InterestingPizza
MargheritaPizza
SohoPizza
SpicyPizza
VegetarianPizza
PizzaBase
PizzaTopping
Spiciness
Pizza — http://www.semanticweb.org/kanur/ontologies/2025/3/pizzaontolog
Annotations
Usage
Annotations: Pizza
Annotations
Description: Pizza
Equivalent To
InterestingPizza
SubClass Of
General class axioms
SubClass Of (Anonymous Ancestor)
hasTopping min 3 PizzaTopping
Instances
Target for Key
Disjoint With
PizzaBase
PizzaTopping
Disjoint Union Of