Lab Modeling Exercise: Discussion

Protégé Short Course
October 09 - October 11, 2017

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Scenario: Hosting Dinner

- Dinner party with guests Mary, Ashok, & Amara
  - Mary likes to have at least one main dish
  - Ashok eats only vegetarian food
- For Mary
  - At least one meat main dish
- For Ashok
  - A vegetarian soup or salad
  - At least one vegetarian main dish
  - A vegetarian dessert
- Dishes to be chosen from an Italian cookbook

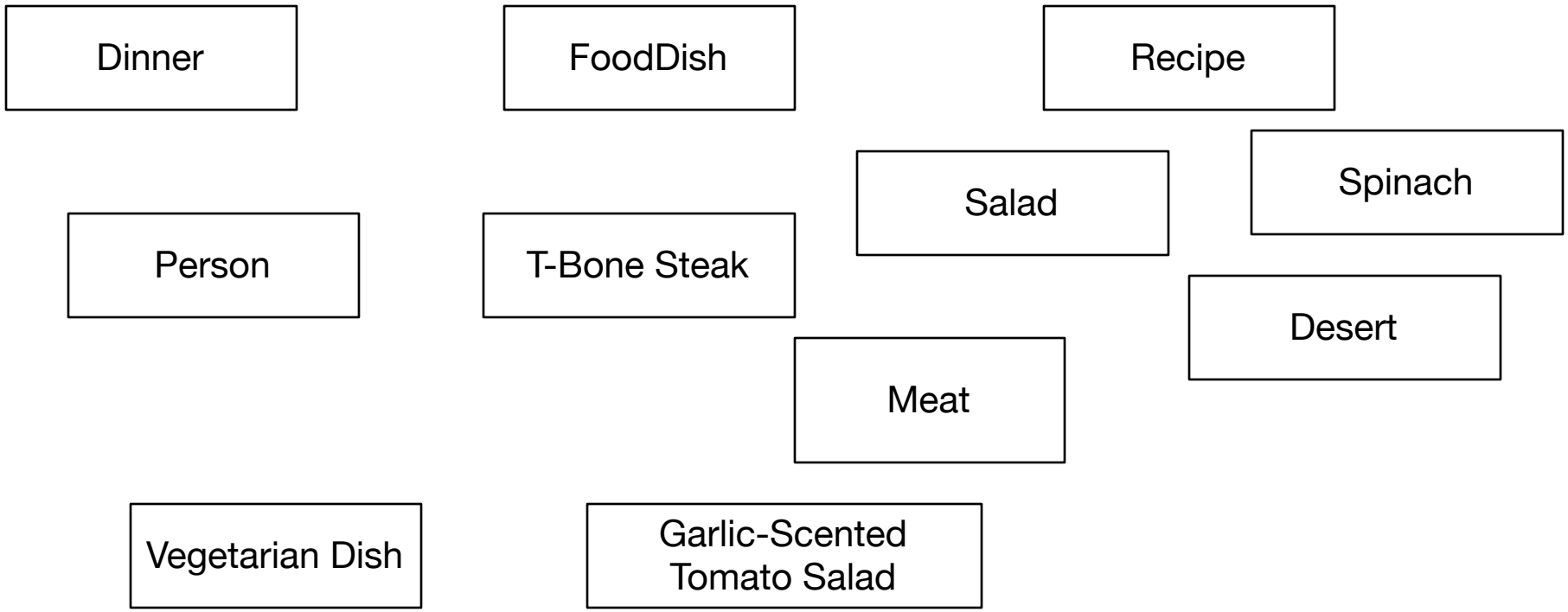
Competency Questions

- Which dishes have meat as an ingredient?
- Which dishes are “meat dishes” and “vegetarian dishes”?
- What are some combinations of dishes
  - that are all vegetarian?
  - that have the combination of meat and vegetarian dishes for your party?

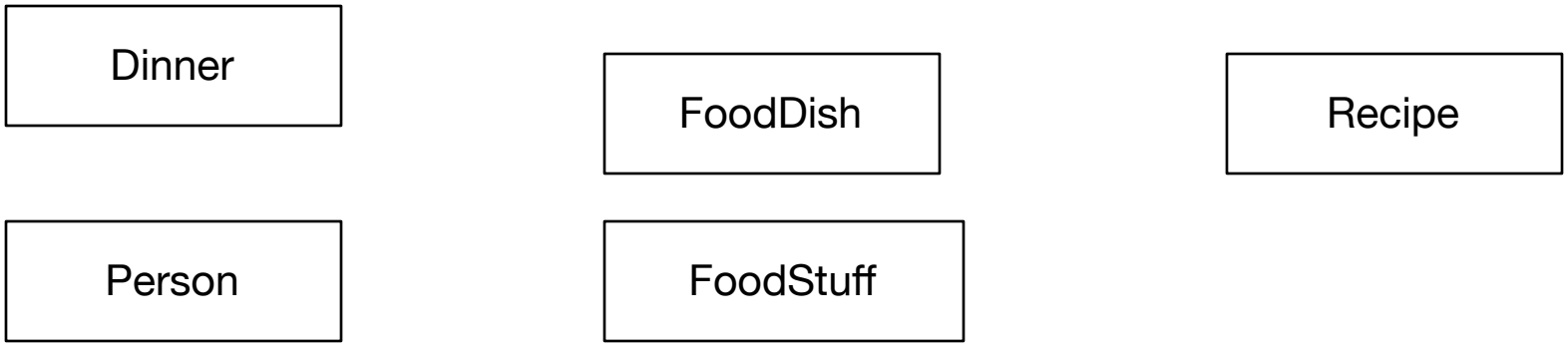
Bonus

- Which recipe gives directions for a particular dish?
- Based on the recipes, what ingredients do you have to get for your dinner?

Conceptualize the Domain: Mental Map of Terms in the Domain

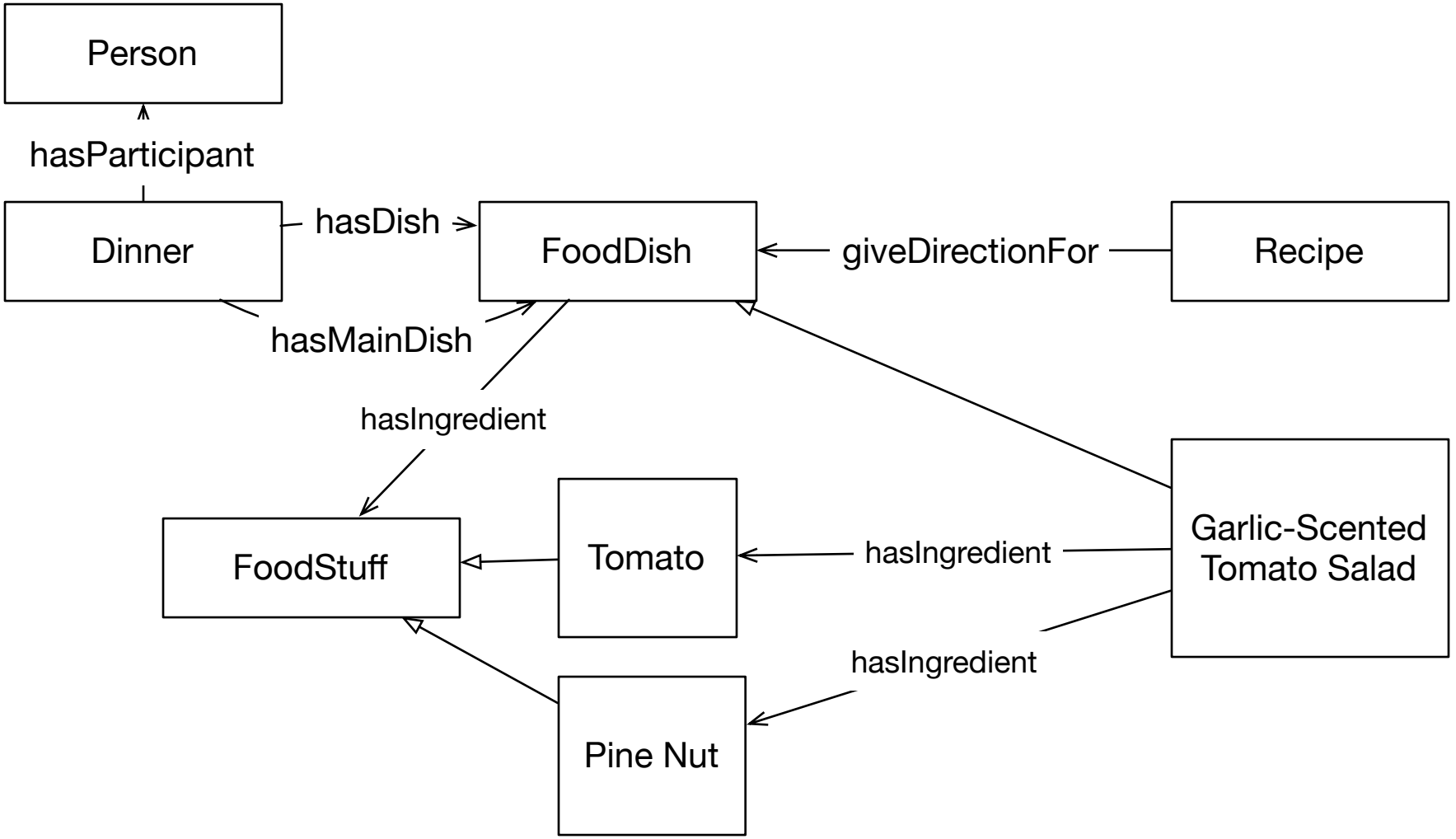


High-Level Concepts in the Domain



- What are examples of subclasses and individuals?
- What relationships should be modeled between these concepts?

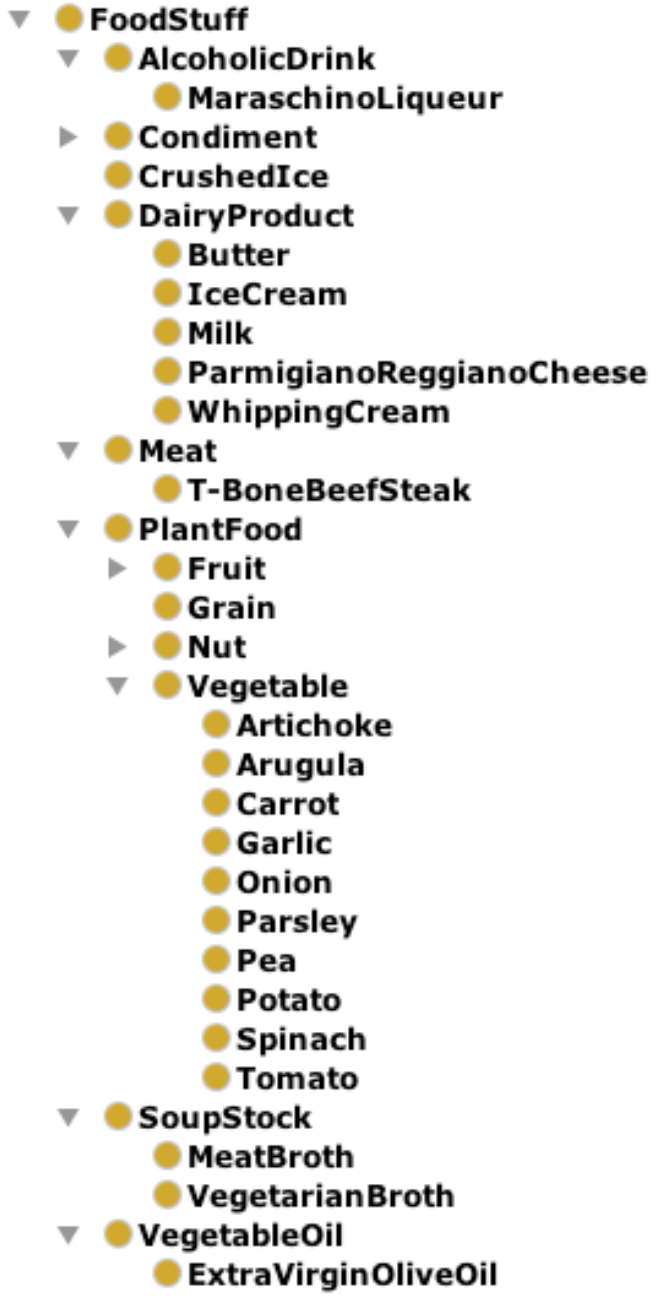
One Possible Conceptualization



Organize FoodStuff into a Hierarchy: Considerations

- Define superclass-subclass relationships that reflect is-a relationships
- Define vocabulary needed to answer competency questions
- Reuse existing definitions
- Siblings should be concepts that are similar in their levels of abstraction

A Possible Hierarchy



As defined in dinner-finished.owl in course materials

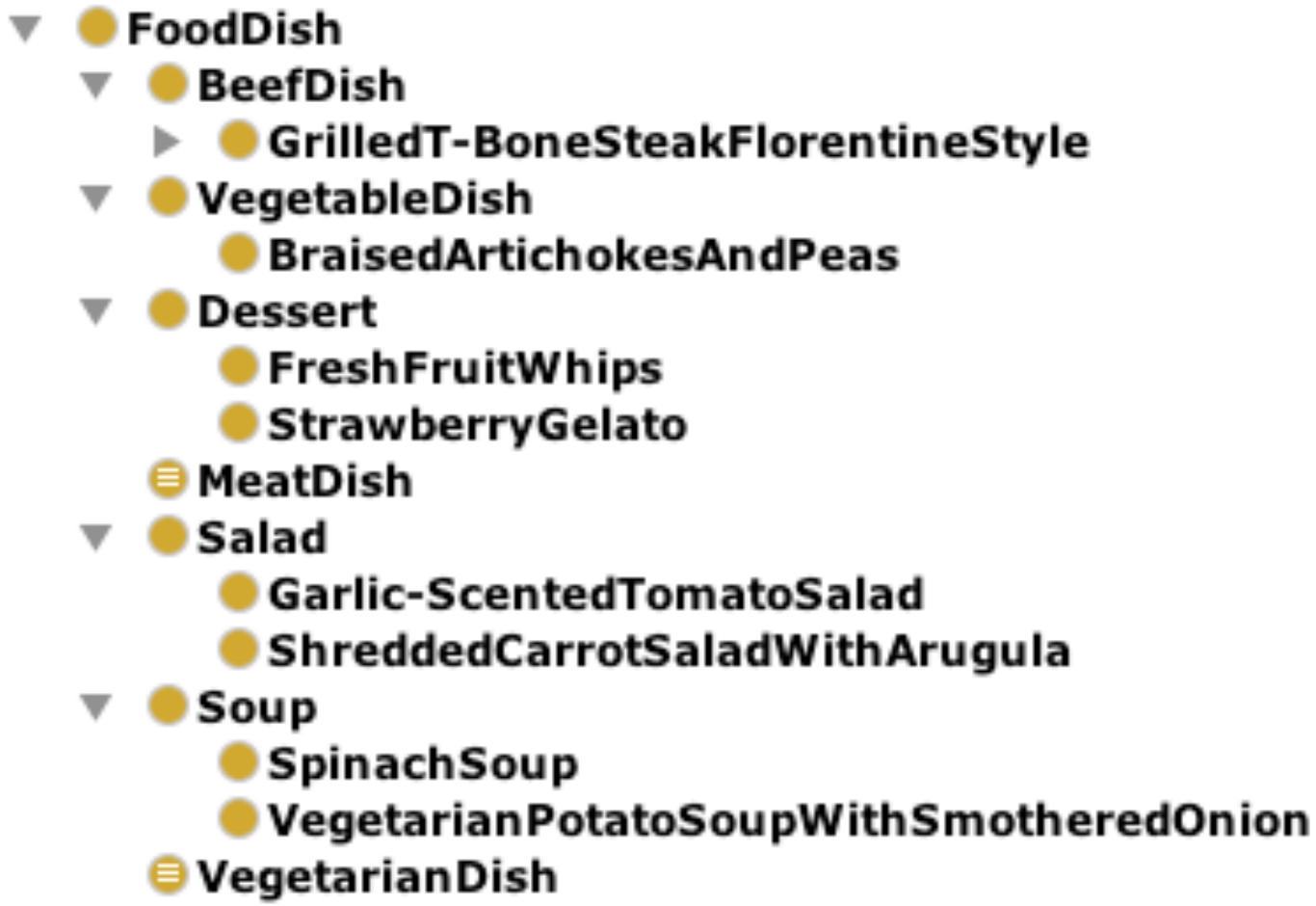
Modeling “FoodDish” and “Dinner”

- Are dishes such as “Braised Artichokes and Peas” classes or individuals?
- Class
  - Collection of individuals
  - Can be specialized
- The dinner I am hosting this Saturday versus the collection of possible dinners someone might give

Modeling Subclasses of "FoodDish"

- Subclasses based on source material
  - Salad, Soup, Beef Dish etc.
- Subclasses based on competency questions
  - Meat Dish
  - Vegetarian Dish
- Defined classes based on
  - Consensus on subject matter (e.g., source material)
  - Classification requirement

One Possible “FoodDish” Hierarchy

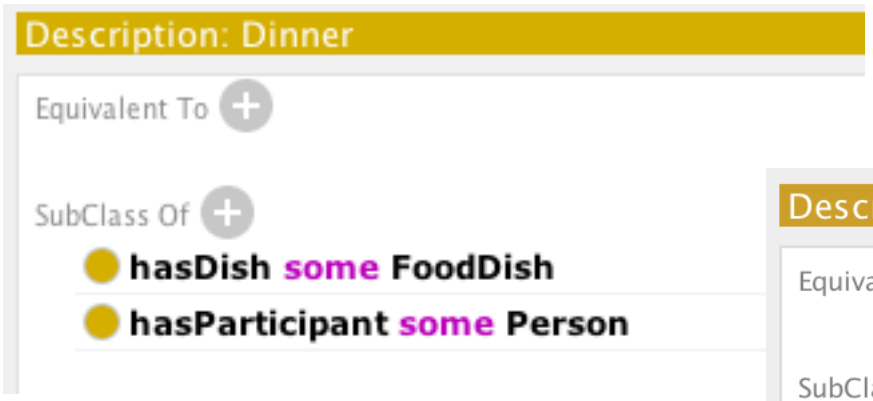


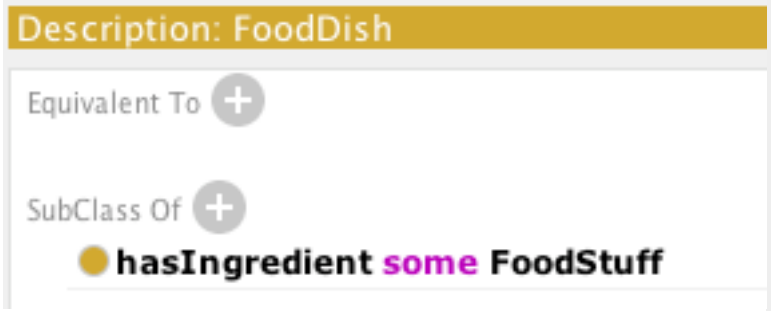
MainDish as a class?

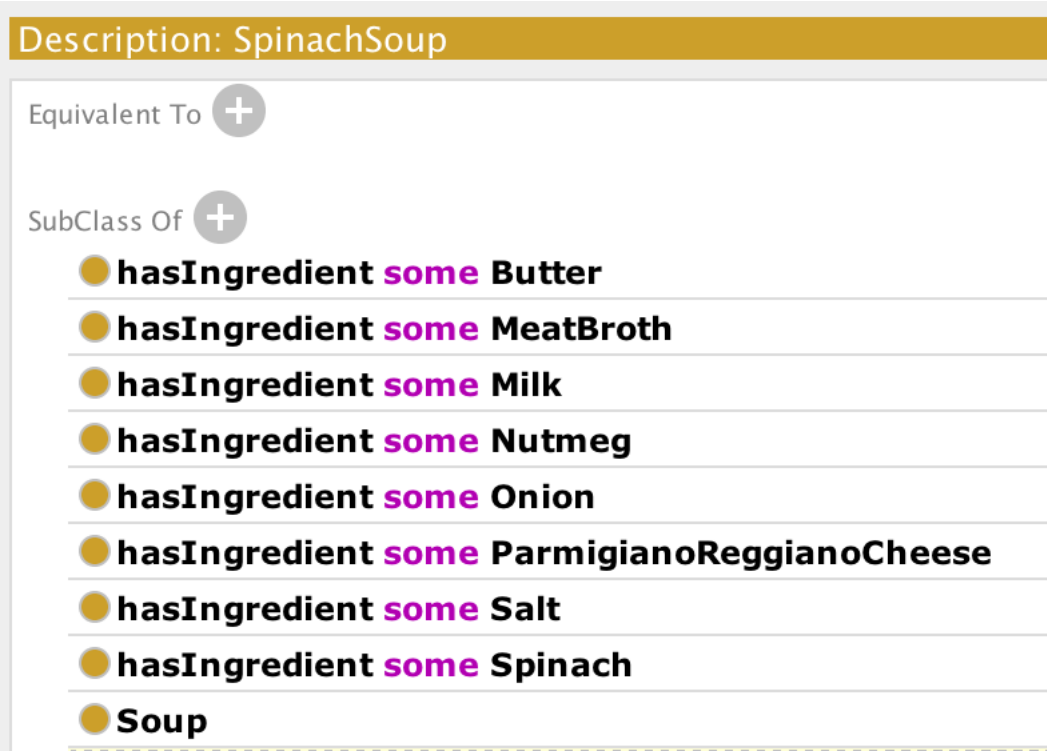
What (Sub)Properties Are Needed?

- Familiar properties
  - Food dish *hasIngredient* some FoodStuff
  - Food dish *contains* some FoodStuff
- New object properties
  - Dinner *hasDish* some FoodDish
  - Dinner *hasMainDish* some FoodDish
  - Dinner *hasParticipant* some Person

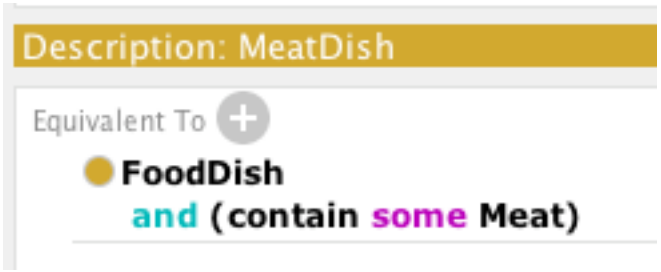
Modeling “Dinner” and “FoodDish”

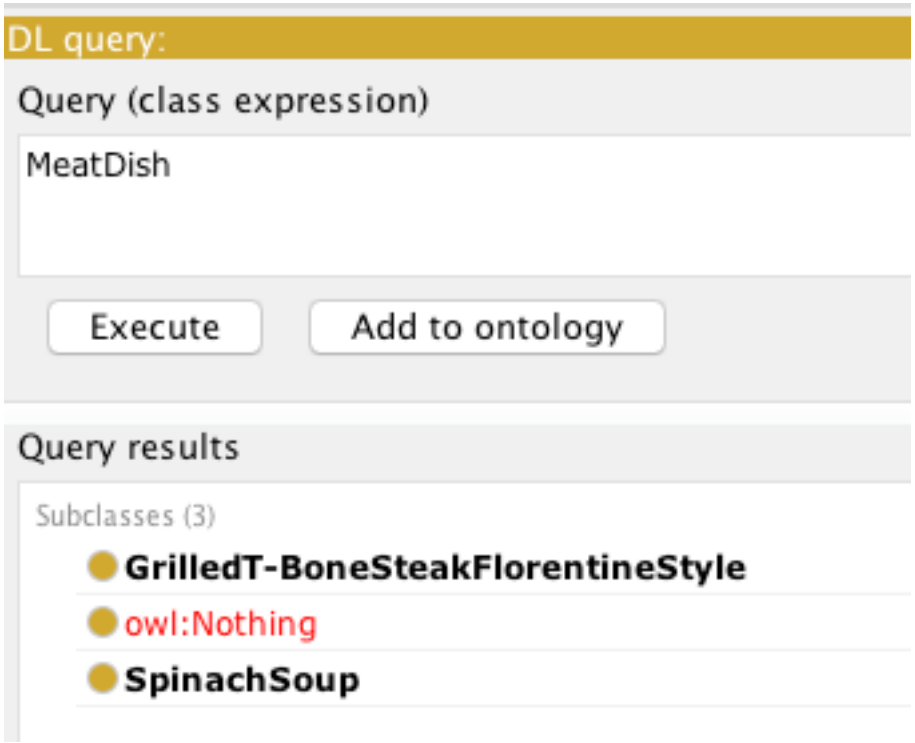




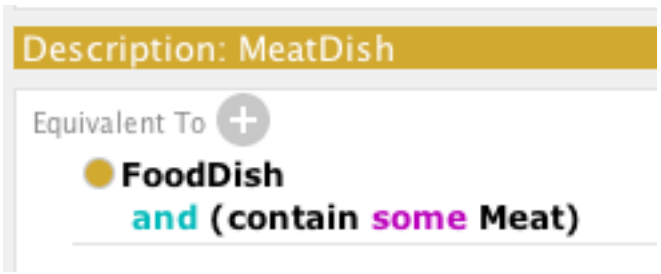


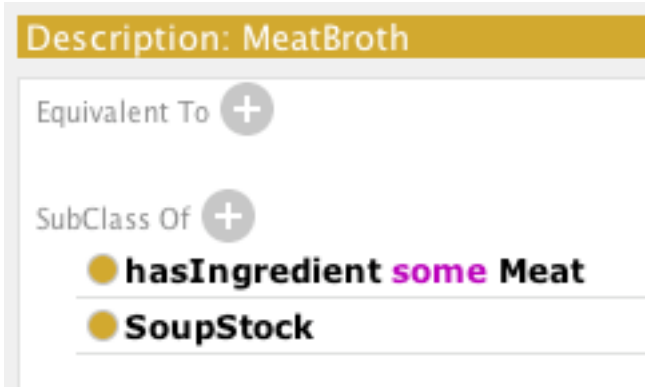
Defining and Querying for “MeatDish”

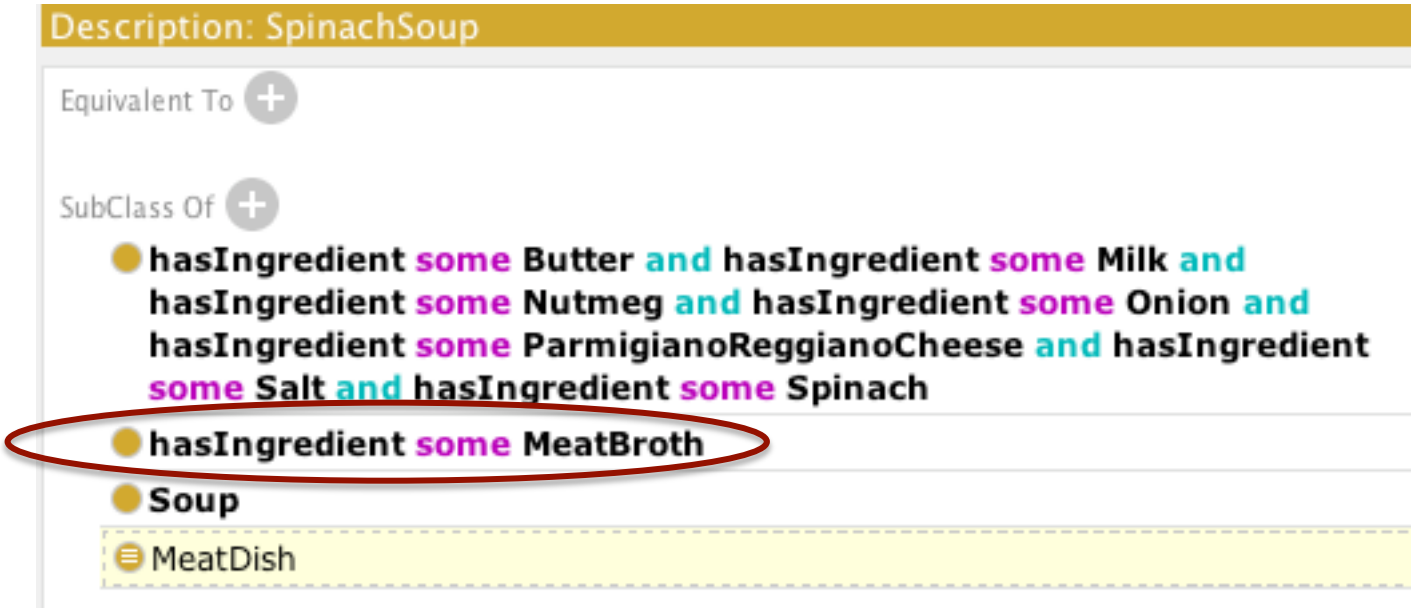




Why is Spinach Soup a “MeatDish”



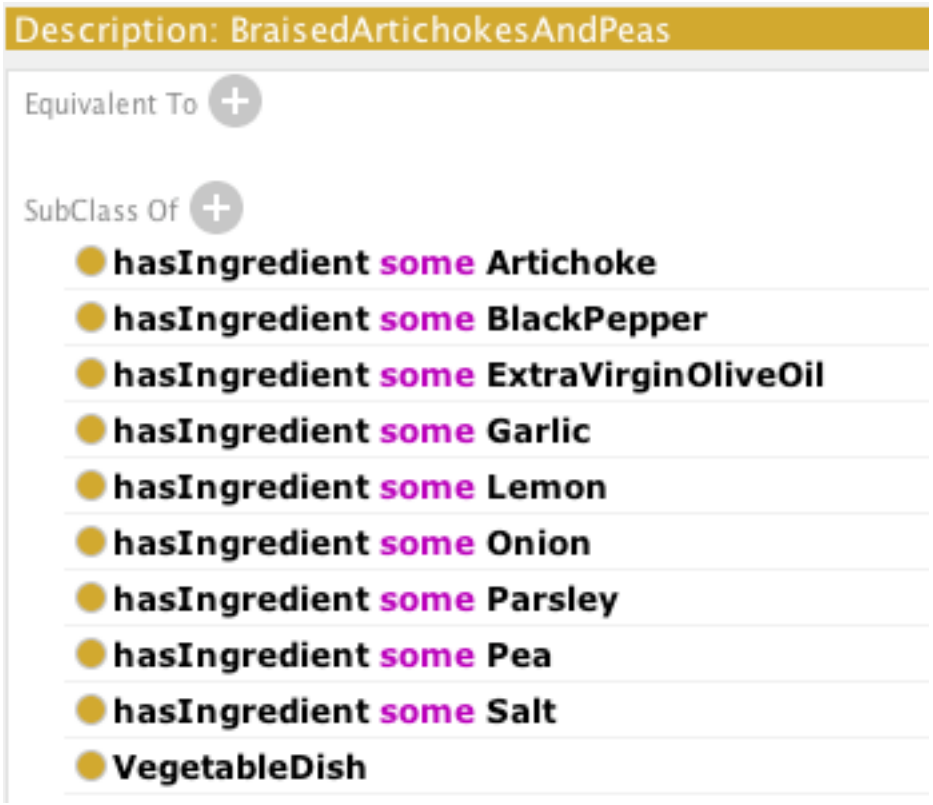




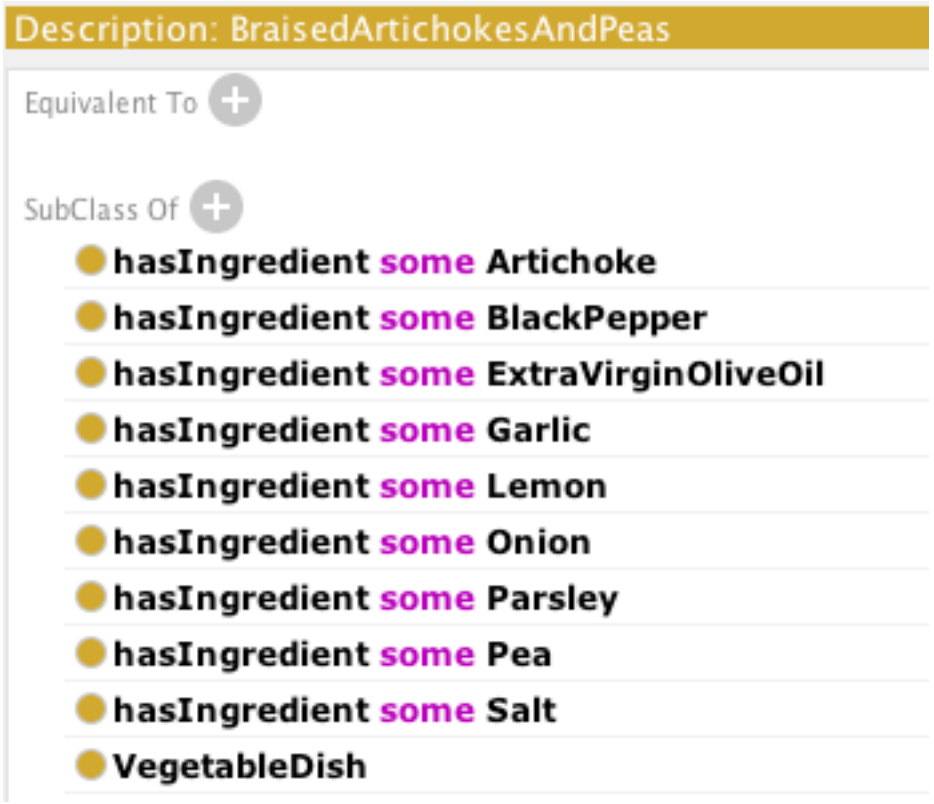
Defining Vegetarian Dish

- A vegetarian dish does not *contain* Meat

Is This Dish Vegetarian?

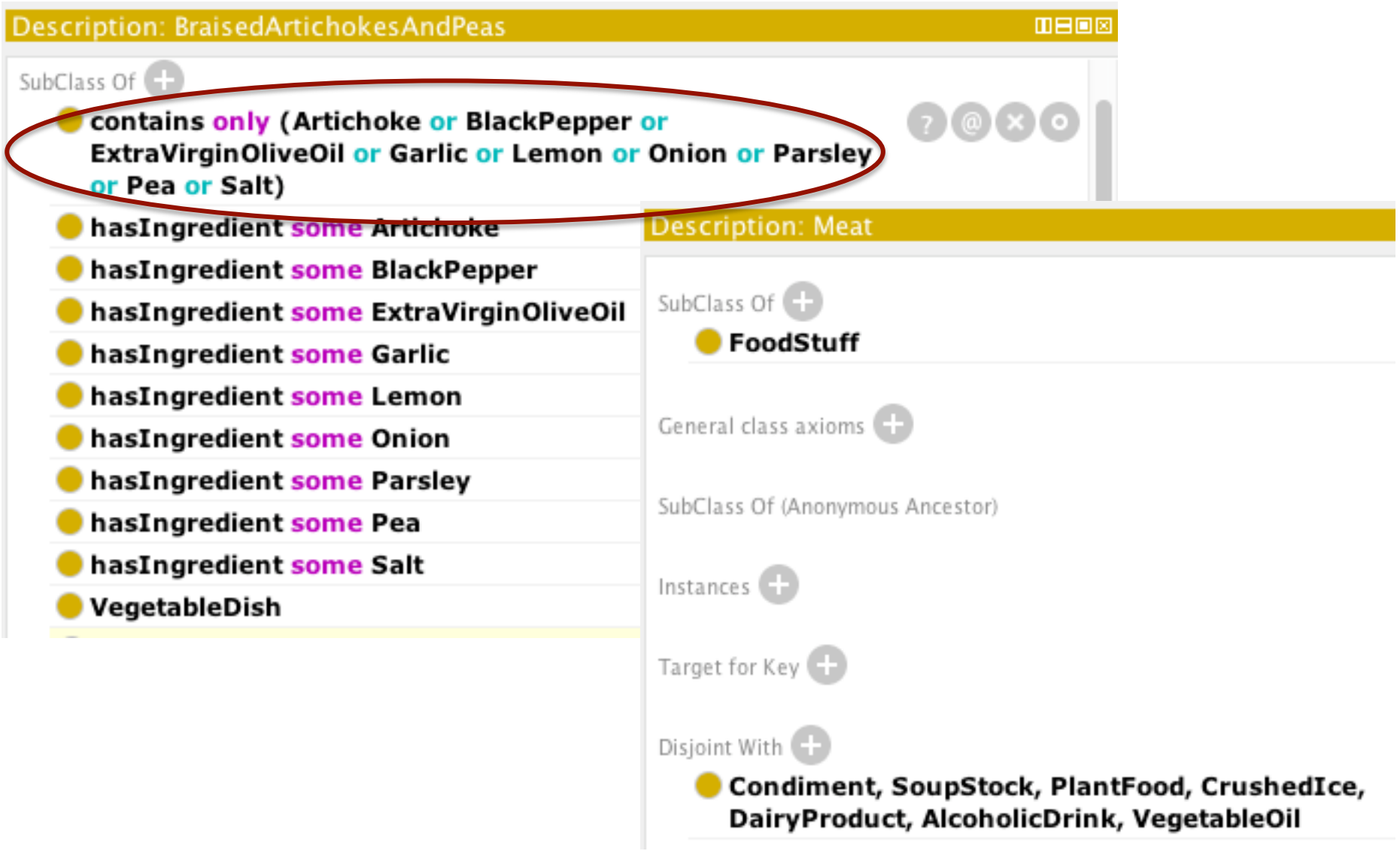


Open-World Assumption

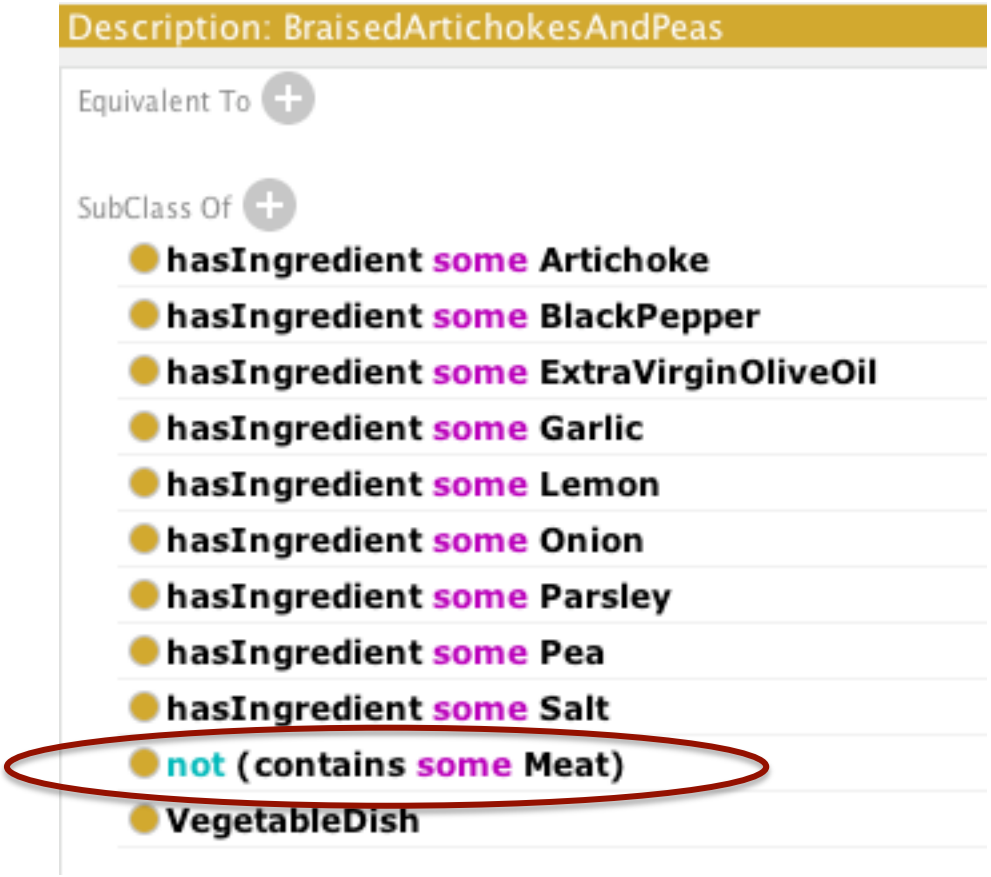


The dish may contain additional (unmentioned) ingredients!

Add Closure Axiom



Alternative Approach



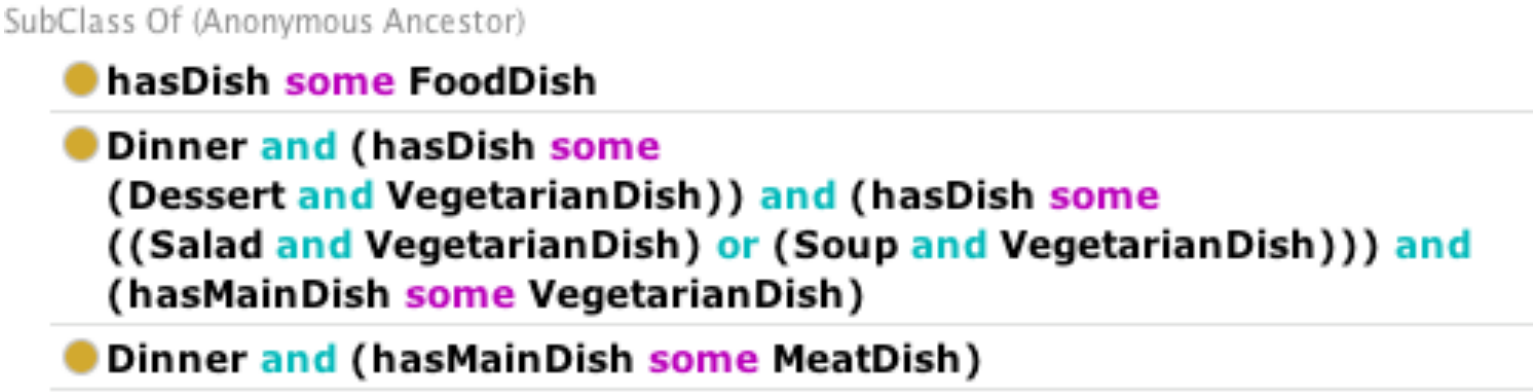
Find Combination of Dishes Suitable for My Dinner

- For Mary
  - At least one meat main dish
- For Ashok
  - A vegetarian soup or salad
  - At least one vegetarian main dish
  - A vegetarian dessert
- What is one minimal list of dishes that would be suitable for both?

General Definition of a Dinner Suitable for My Party:

A vegetarian soup or salad
At least one vegetarian main dish
A vegetarian dessert

At least one meat main dish



A Dinner Suitable for My Party: Specific Choices

A vegetarian soup or salad
At least one vegetarian main dish
A vegetarian dessert

At least one meat main dish

Is this what you expect?

Modeling "Recipe"

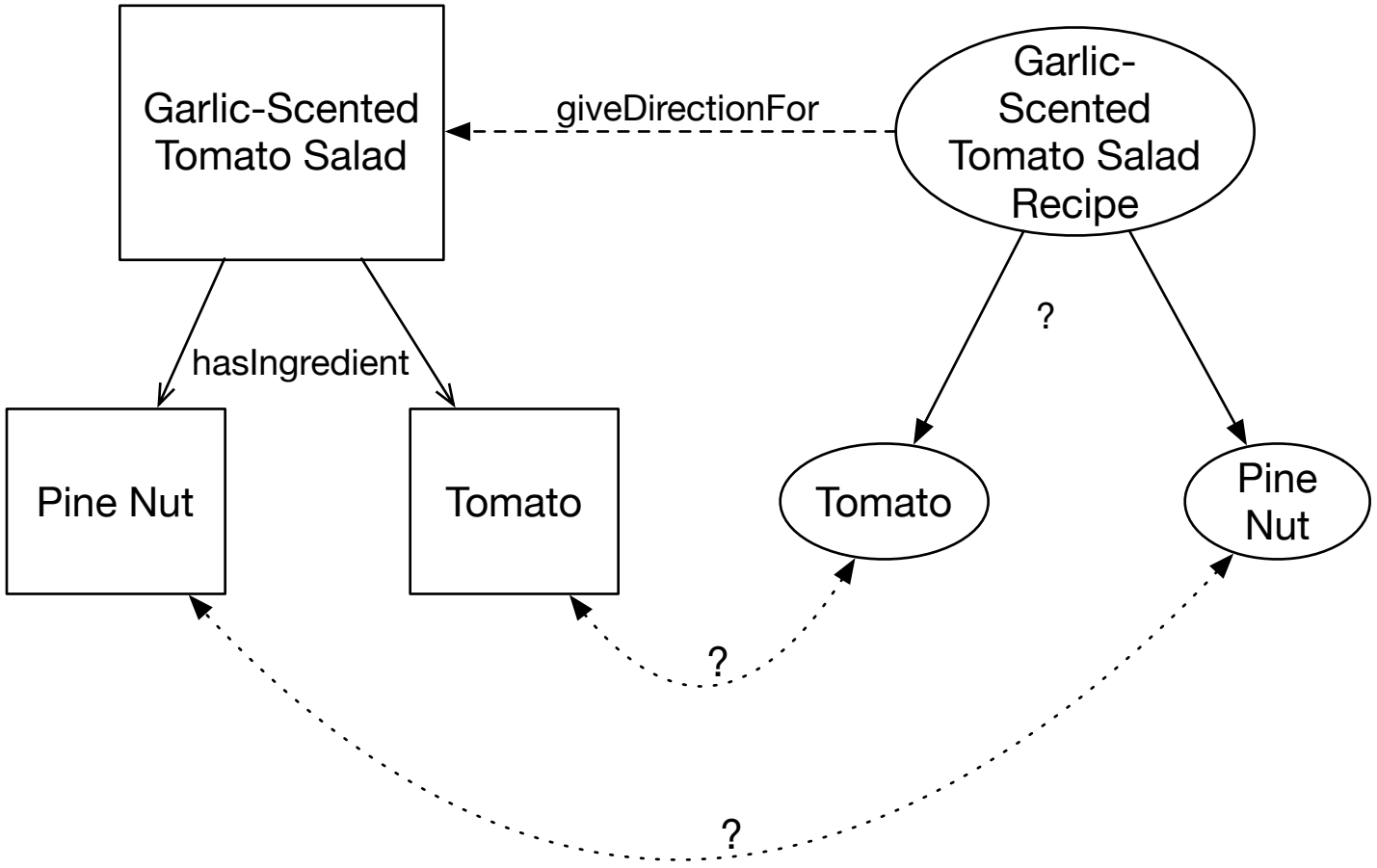
From the book *Essentials of Classic Italian Cooking* by Marcella Hazan

Garlic-Scented Tomato Salad
For 4 or 6 servings

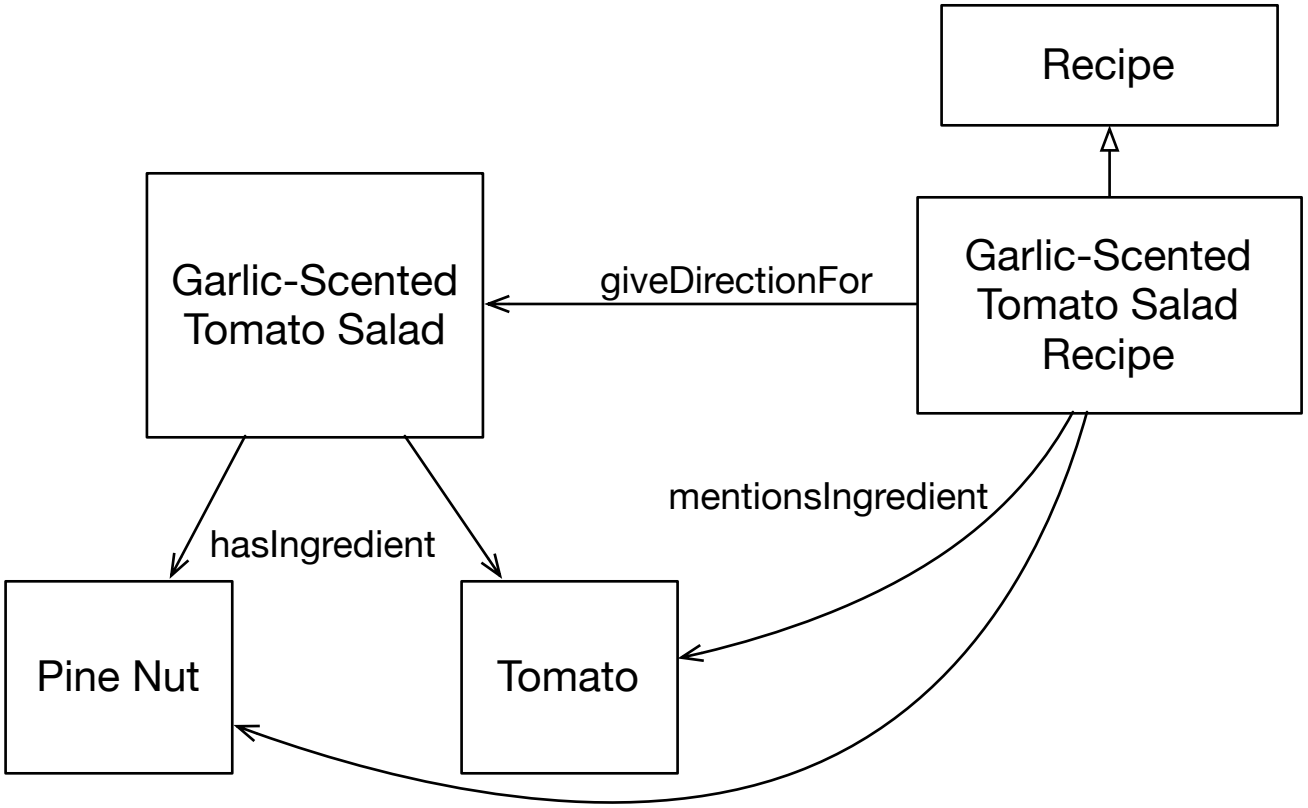
- 4 to 5 garlic cloves
- Salt
- Pine nuts
- Choice quality red wine vinegar
- 2 pounds fresh, ripe, firm, round or plum tomatoes
- 1 dozen fresh basil leaves
- Extra virgin olive oil

What are classes and what are individuals?

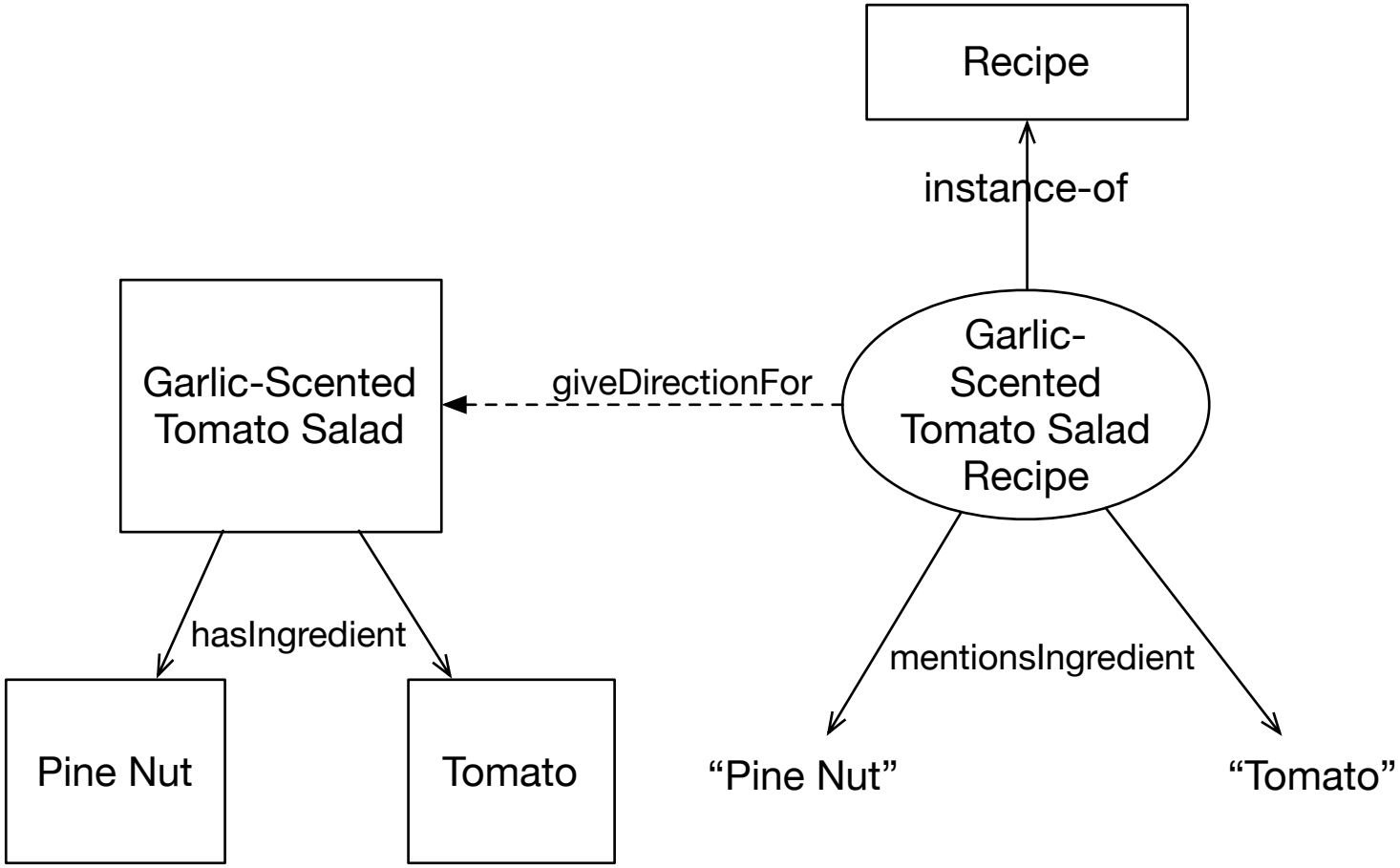
What are the Relationships Between Terms in a Recipe and Ingredients in a Dish?



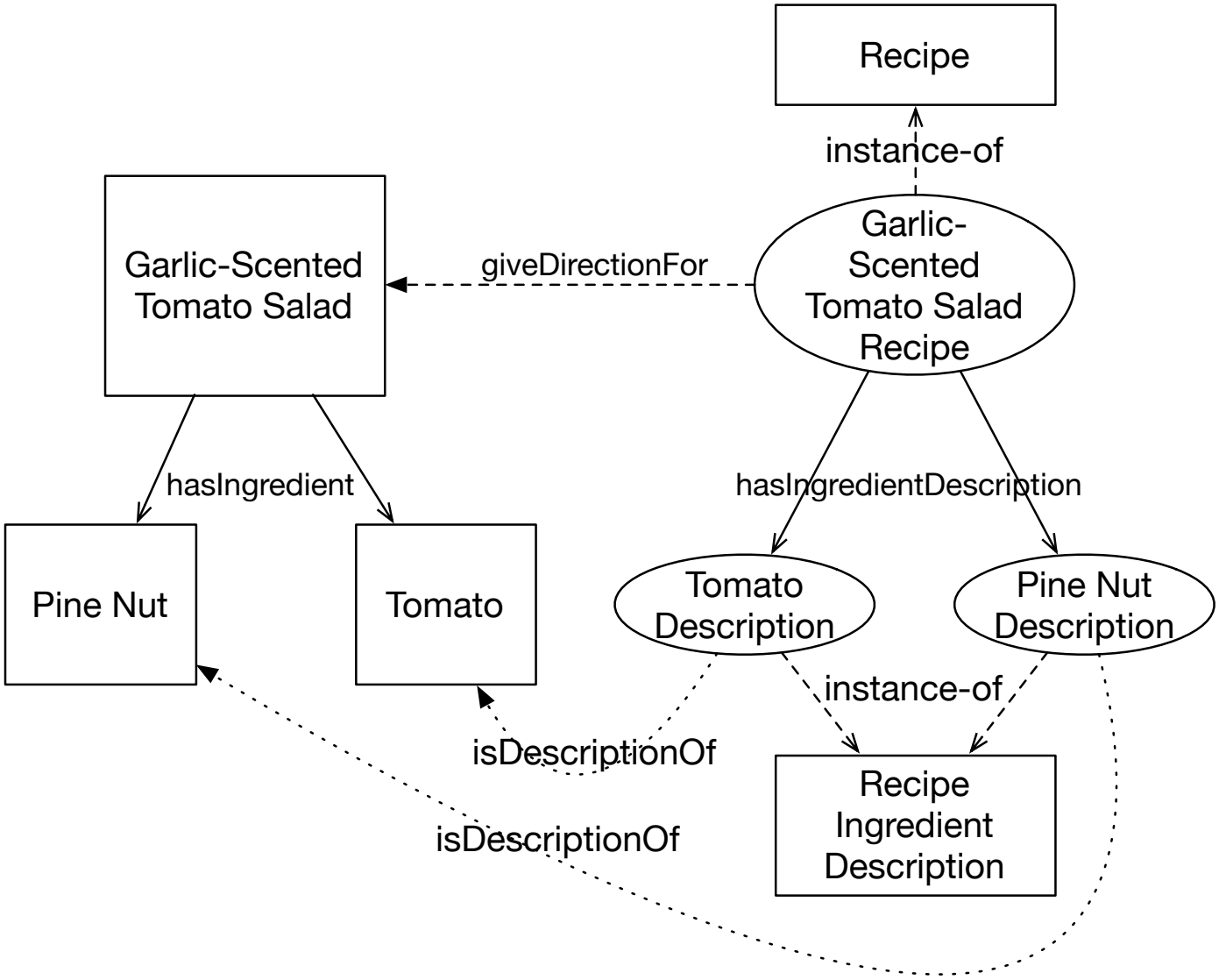
“Recipe” Modeling Choice 1



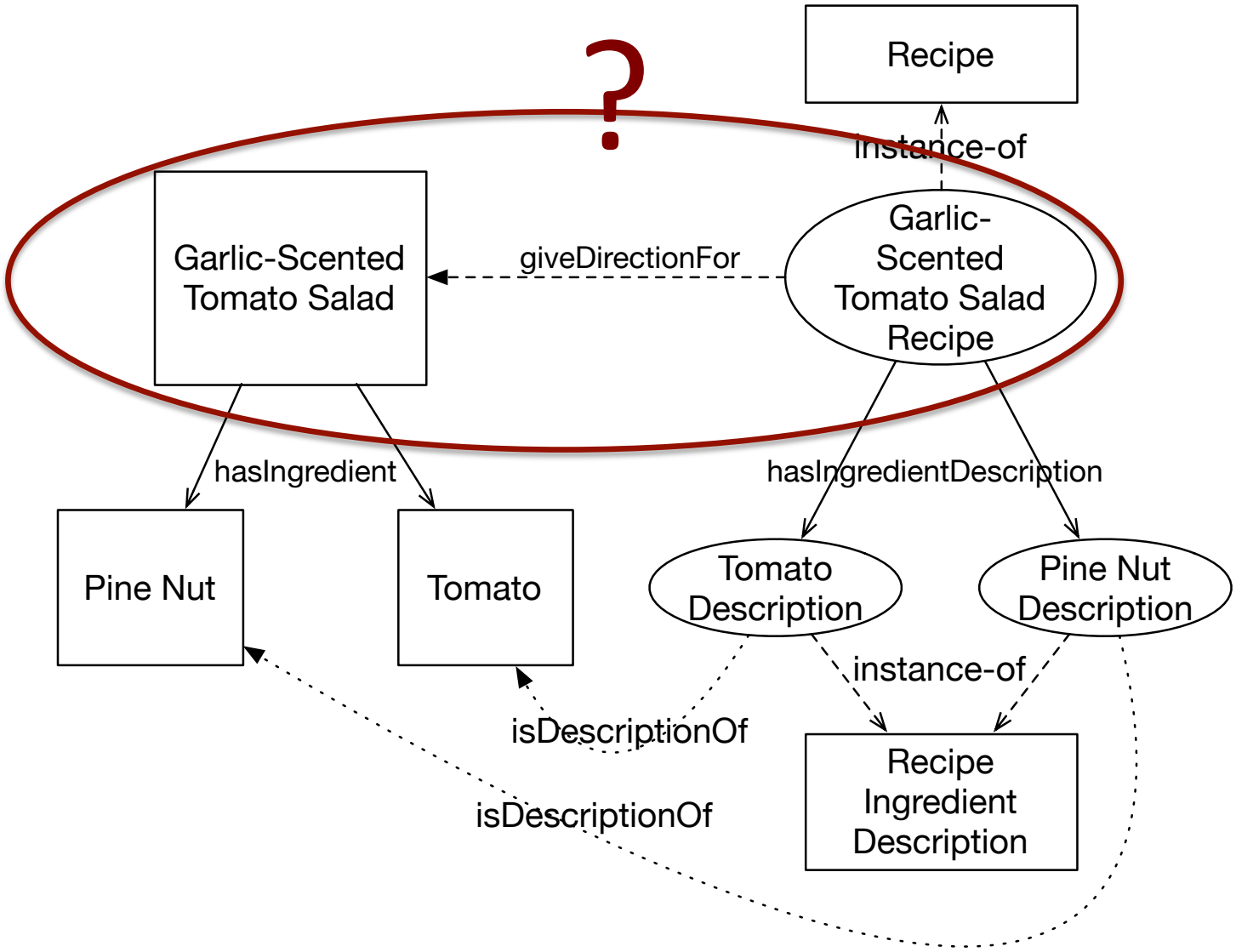
“Recipe” Modeling Choice 2



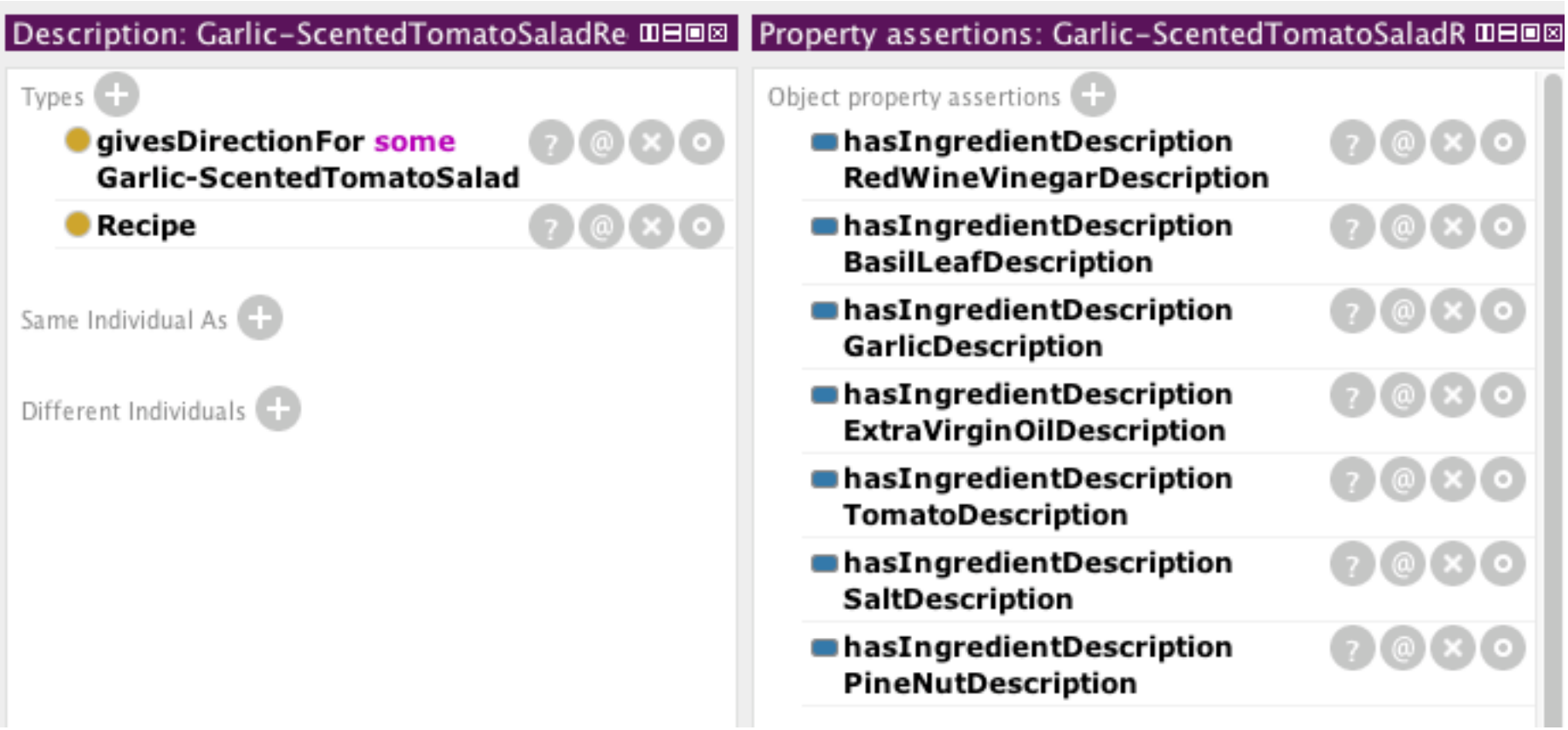
“Recipe” Modeling Choice 3



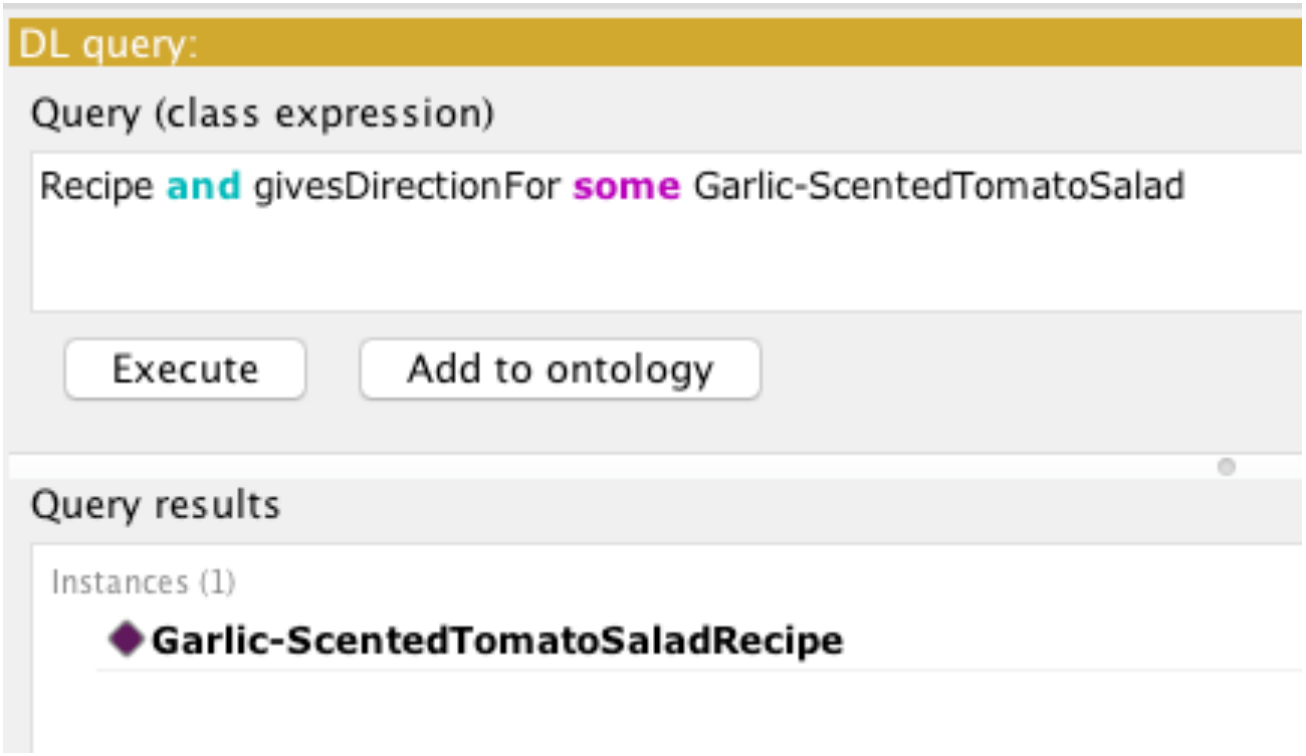
Implementing “Recipe”



Garlic-Scented Tomato Salad Recipe

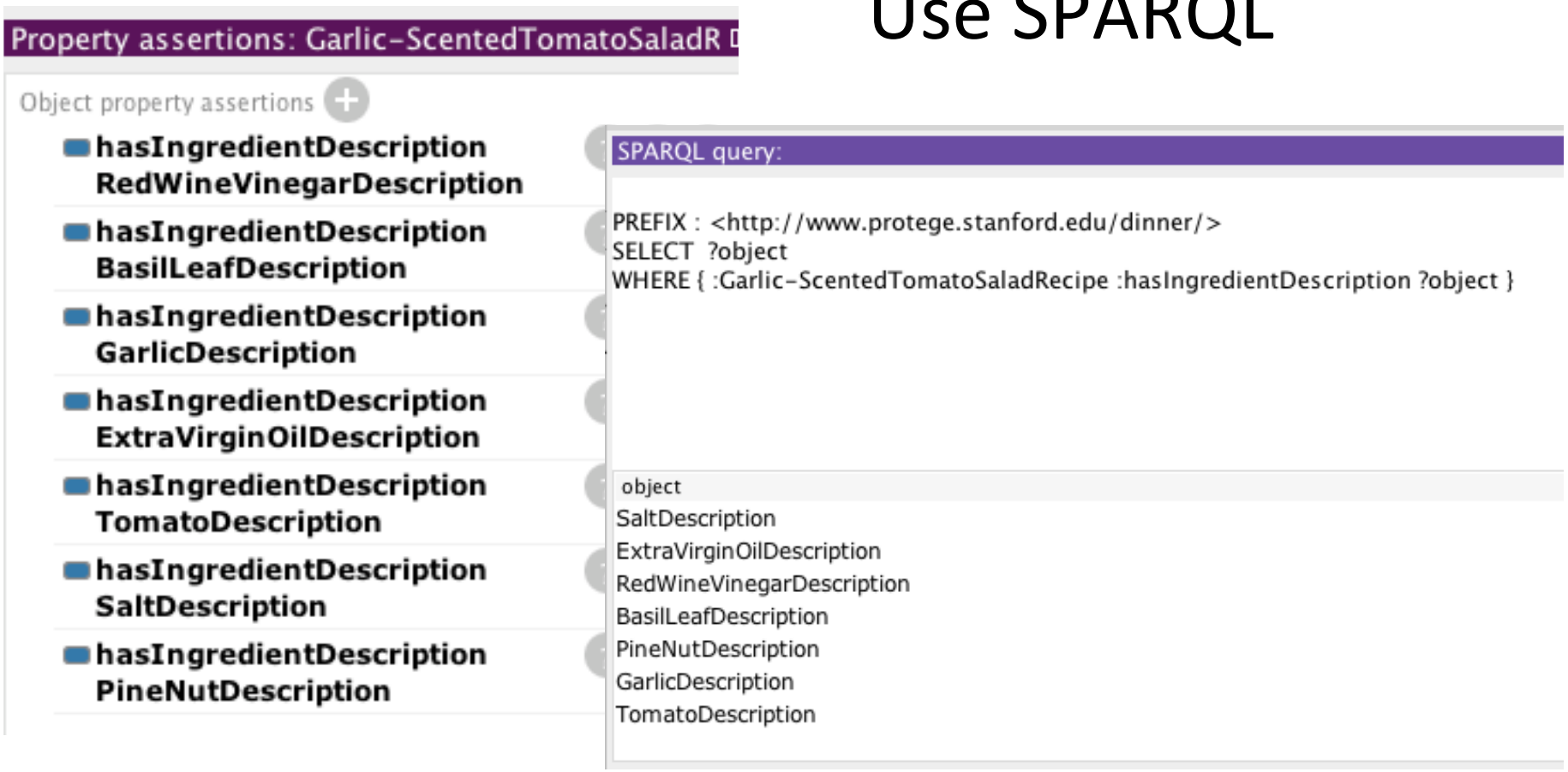


Query for Recipe that Gives Direction for a Garlic-Scented Tomato Salad

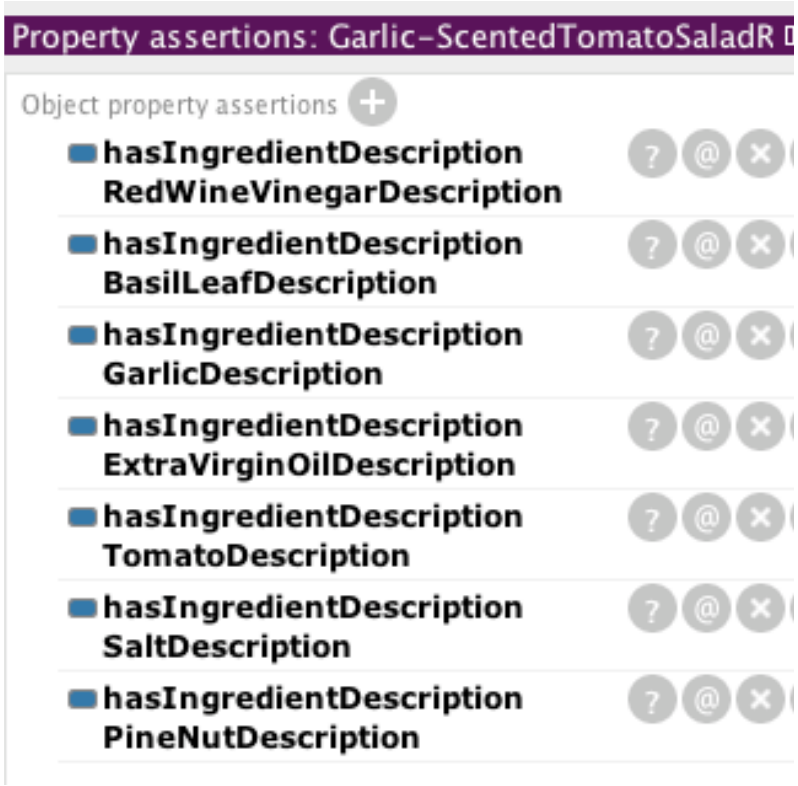


Query for Ingredients Descriptions of a Recipe

Use SPARQL



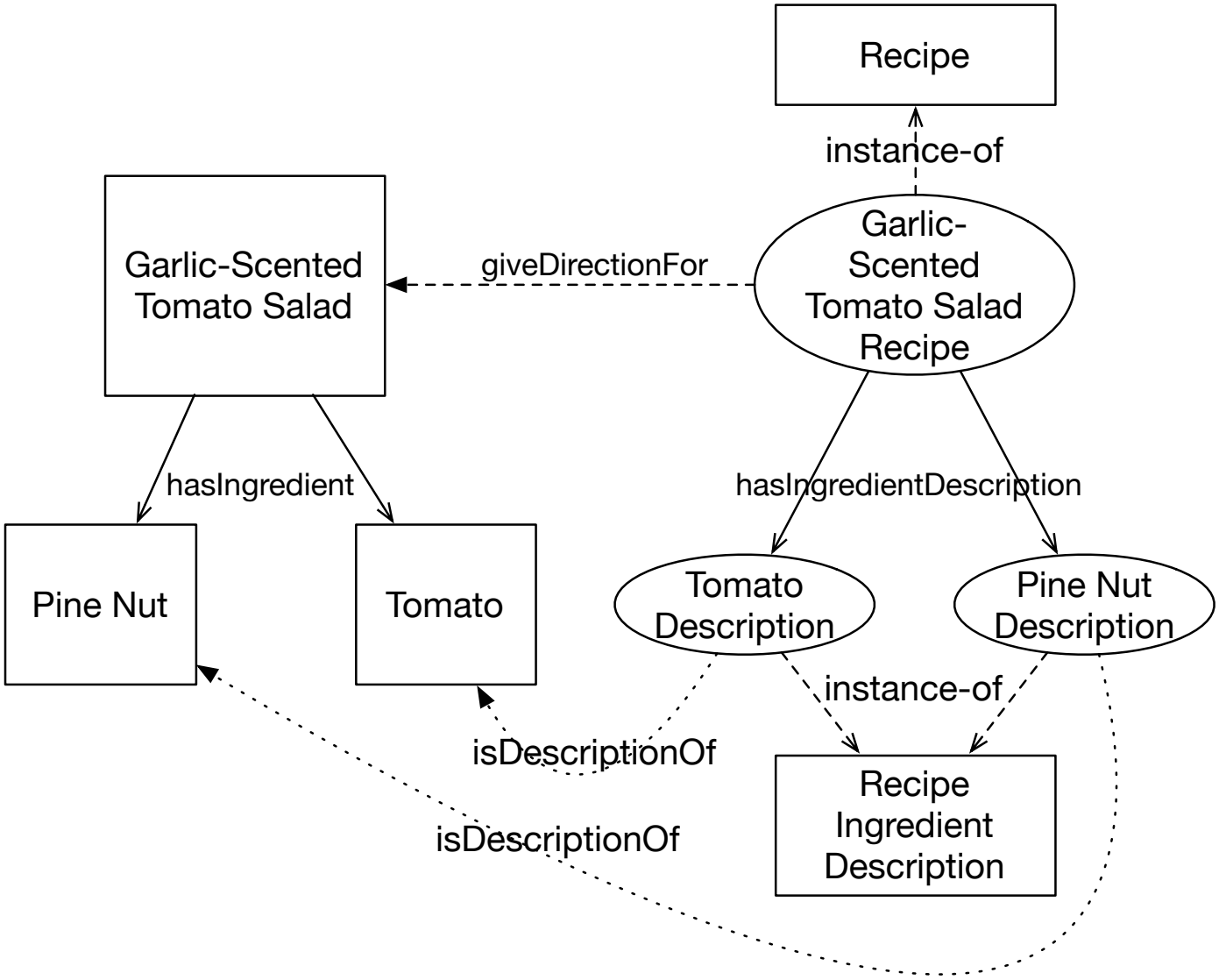
Class Expression for Ingredient Descriptions of a Recipe?



- Find the set of ingredient descriptions that *are mentioned in* the Garlic-Scented Tomato Salad recipe

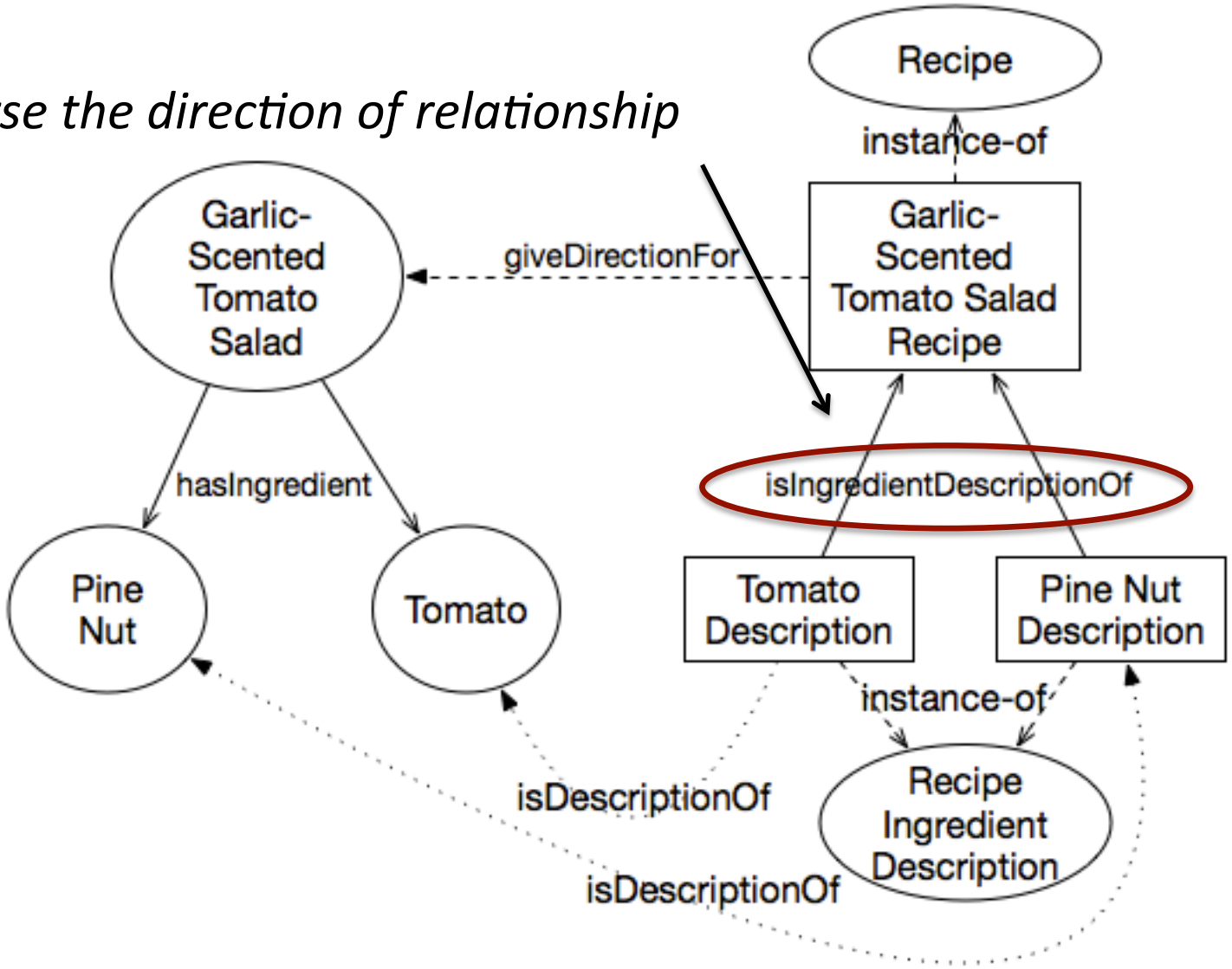
RecipeIngredientDescription and (?? ?? GarlicScentedTomatoSaladRecipe)

“Recipe” Modeling Choice 3

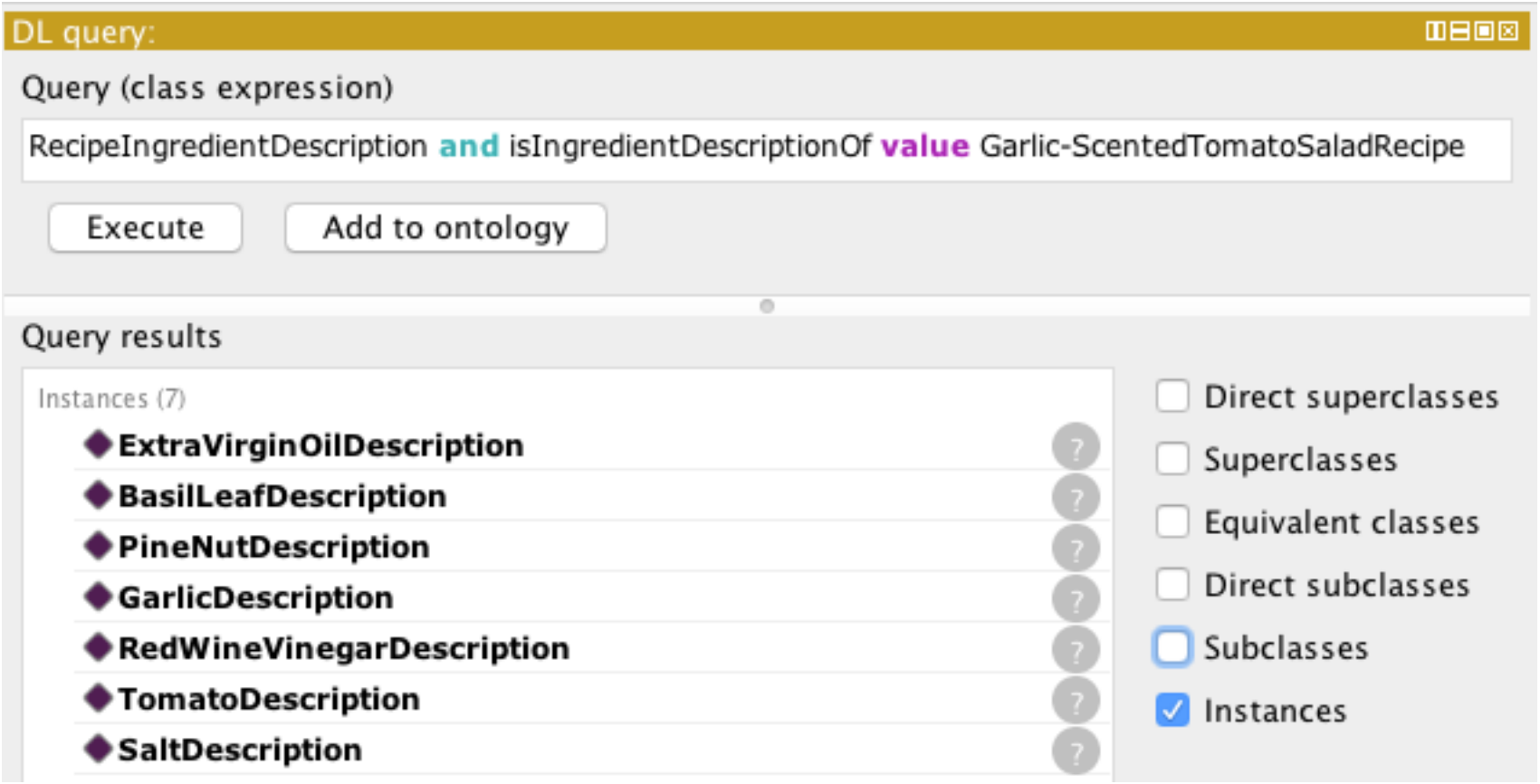


Ingredients Mentioned in a Recipe

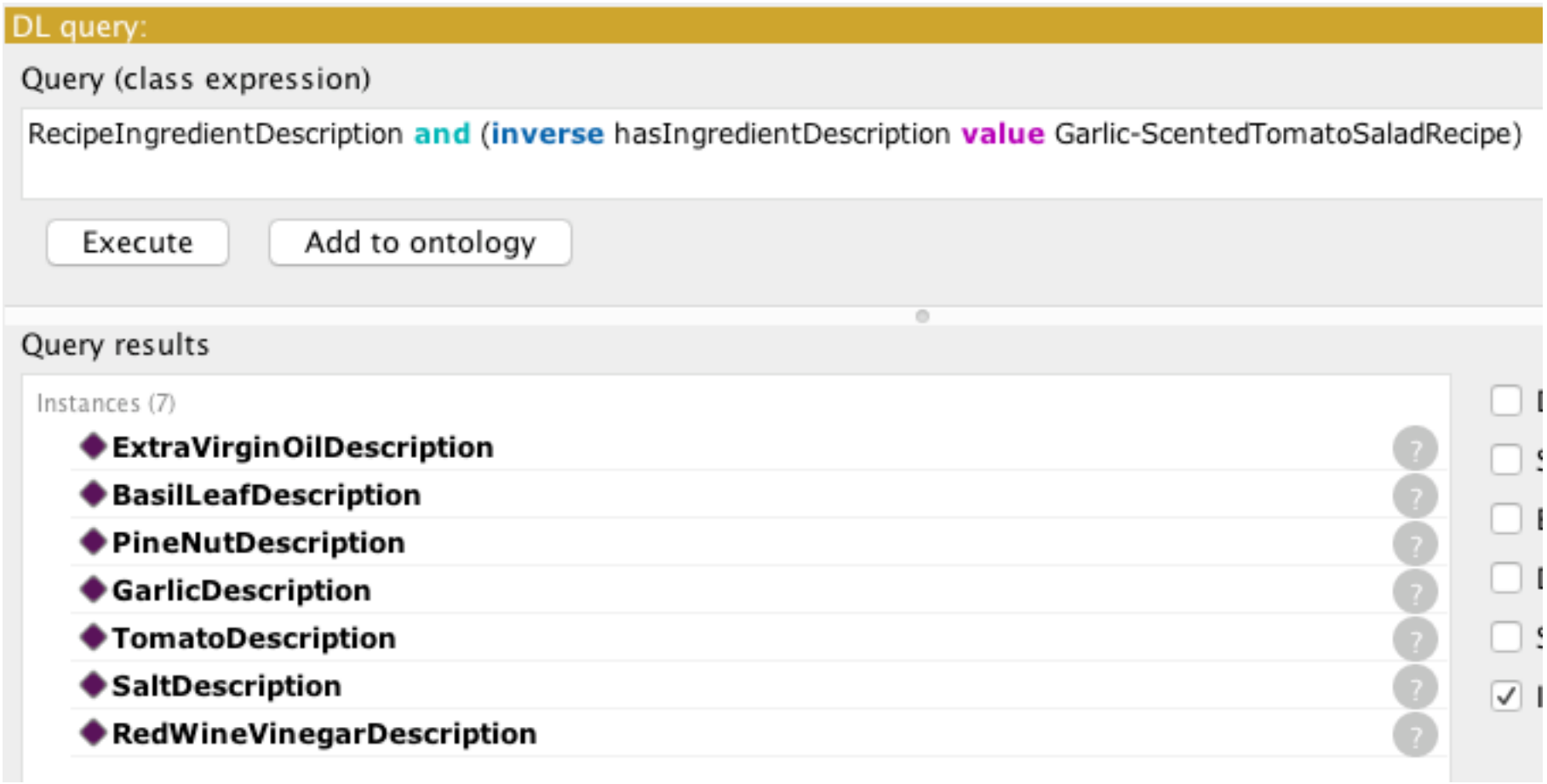
Reverse the direction of relationship



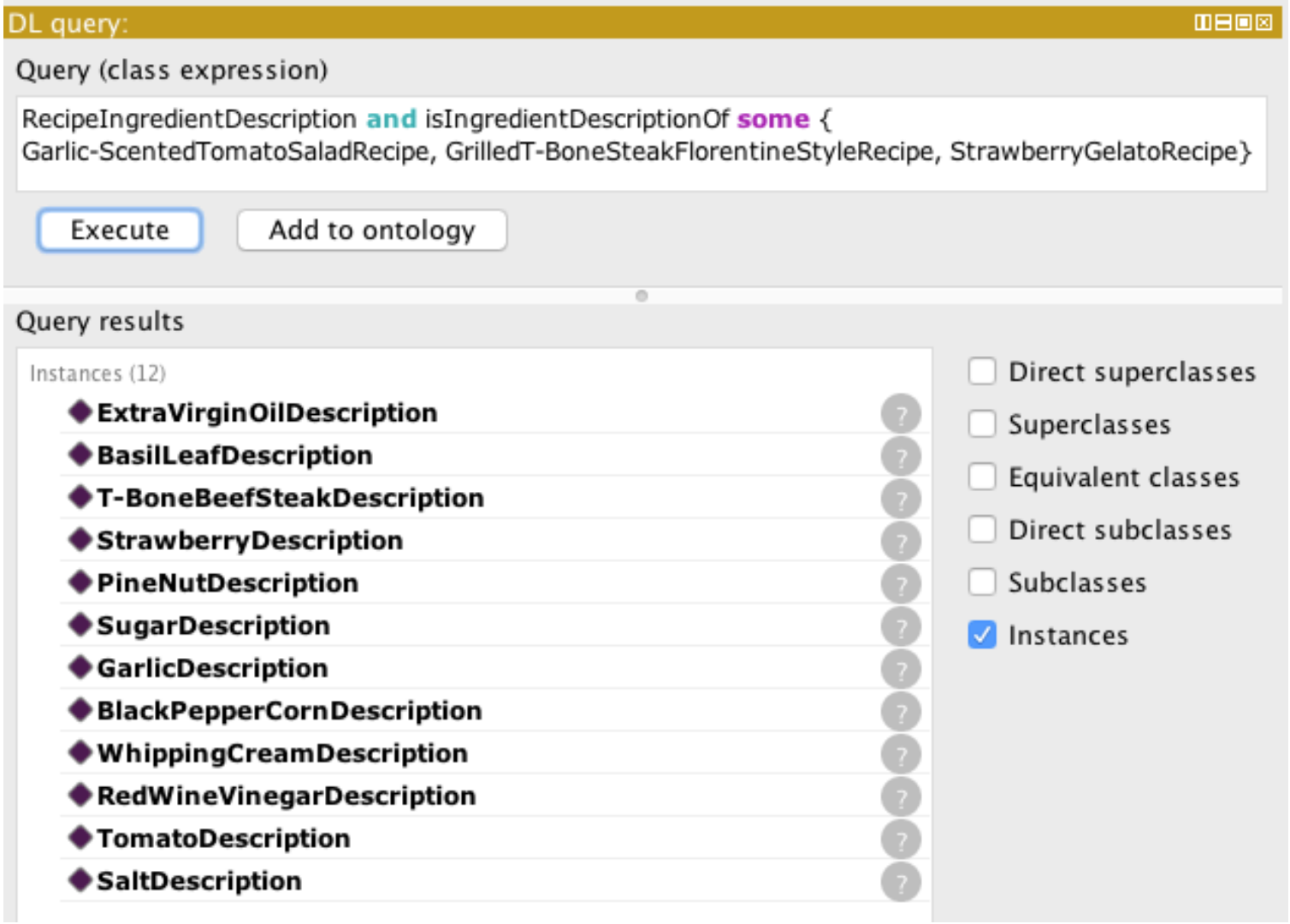
Query Ingredients Mentioned in a Recipe



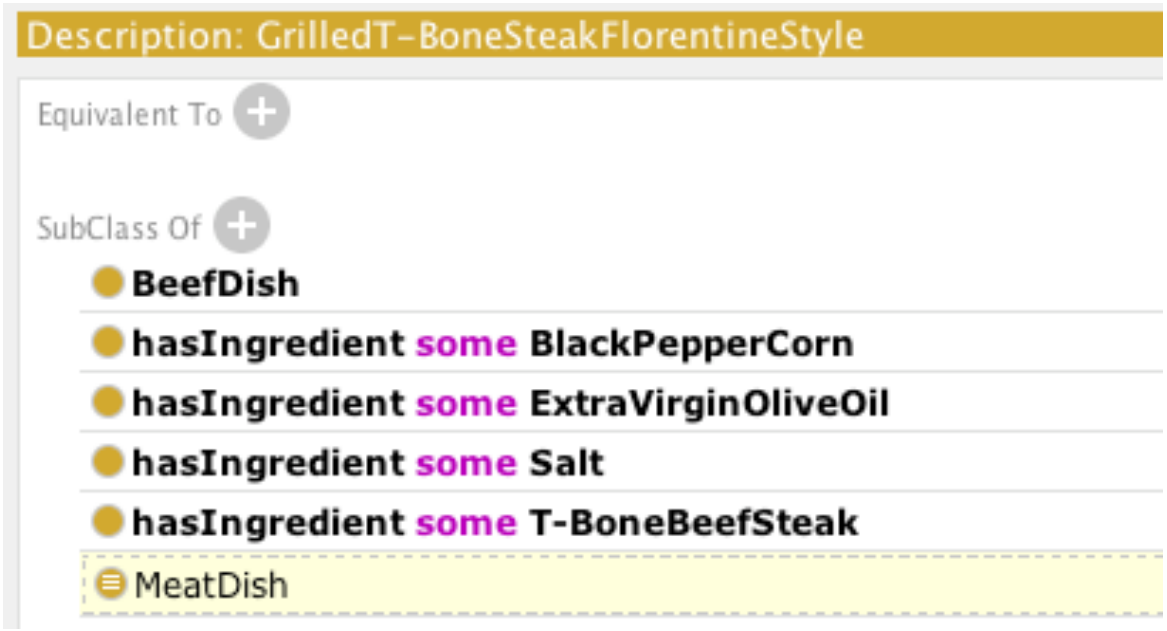
Query Ingredients Mentioned in a Recipe (Use Inverse Property)

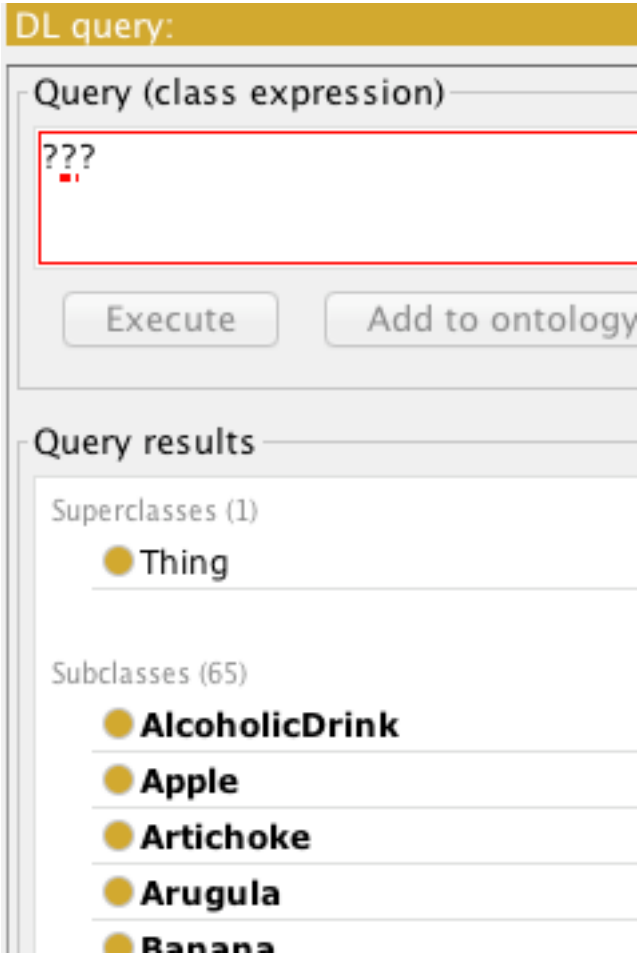


What Ingredients Do You Have to Get?



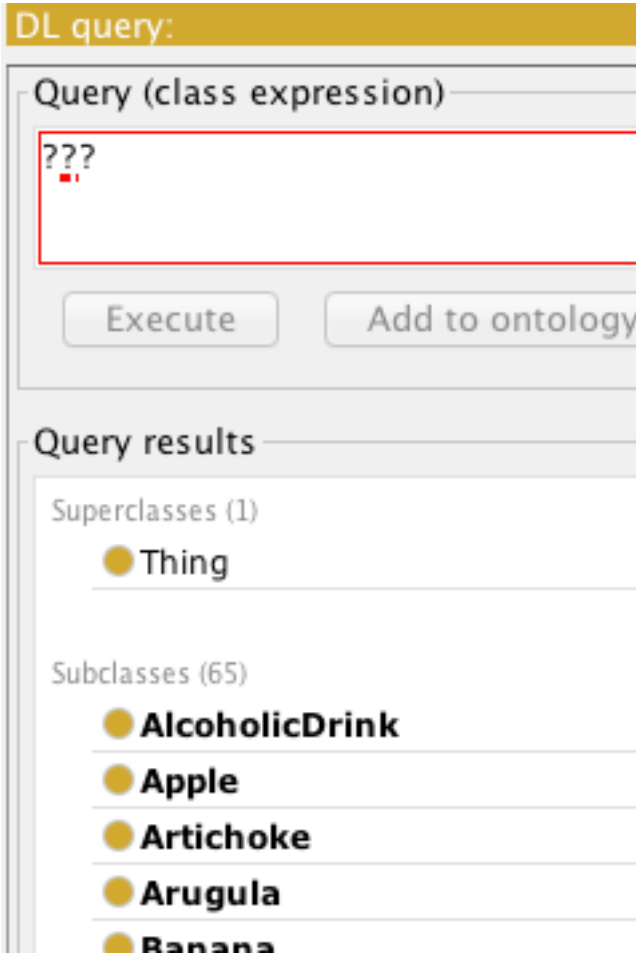
Can you write a DL query to get the ingredients of the dishes?





Querying for Ingredients of Dishes

- DL query is a class expression for which ingredients need to be subclasses/superclasses/ individuals
- Each dish uses **some**, not all, individuals of ingredient class
- Easier to query for ingredient descriptions of recipes: construct a class whose individuals are the desired ingredient descriptions



Modeling Exercise

- Conceptualization of domain
  - Food stuff, food dish, dinner and their properties
- Modeling decisions
  - Recipe and its relationship to food dish
- OWL language
  - Classes, properties, individuals, restrictions
- Queries
  - SPARQL, DL query