PizzaOntology

Motivazioni

Questa ontologia è mirata alla definizione del mondo della ristorazione per quello che riguarda la pizza, esplicitando le caratteristiche del piatto, i processi di lavorazione e le tipologie.
Inoltre, vengono definiti anche i luoghi in cui la pizza viene creata, andando a descrivere la quantità di persone che lavorano come pizzaioli all'interno del ristorante.
Vengono infine definiti gli ingredienti e i possibili disturbi alimentari che un utente potrebbe avere, cercando così di individuare quale sia la pizza perfetta per l'utente.
Questo permetterebbe di aiutare gli utenti che vogliono cercare la pizza migliore disponibile al momento dando importanza agli ingredienti, ai disturbi alimentari e possibilmente anche alla persona incaricata di creare la pizza richiesta, andando così a velocizzare il tempo di decisione della migliore pizza da acquistare.

Requisiti

Finalità

L'ontologia ha come scopo l'affiancamento degli utenti per la ricerca della migliore pizza possibile secondo i criteri di scelta individuati, riuscendo a dare maggiori informazioni anche sui lavoratori e sul tipo di pizza che viene fornito dalle pizzerie.
Tramite una lista di opzioni fornite dall'ontologia, l'utente riuscirà a fare una scelta più consapevole, tenendo in conto le linee guida individuate, per la scelta della migliore pizza disponibile.
Si presuppone, ovviamente, che ci sia un modo per far si che lo user possa contattare senza sforzo i ristoranti, andando ad indicare la pizza scelta.

Task

L’ontologia vuole coprire, nello specifico, questi task:

- Definizione delle pizze disponibili e le loro principali caratteristiche.
- Definizione dei processi utilizzati per la creazione della pizza.
- Definizione di eventuali disturbi alimentari dell'utente e conseguente eliminazione delle pizze che non risultano coerenti con questi.

Utenti di riferimento

Gli utenti che vengono tenuti in considerazione in questa ontologia sono:

- Amanti della pizza che vogliono scoprire nuove tipologie di pizze.
- Pizzerie che vogliono farsi conoscere da più clienti.

Descrizione del dominio

Dominio

Il dominio vuole rappresentare le **pizze**, le **pizzerie**, gli **ingredienti**, le **tipologie di pizza** e i **processi** utilizzati per la creazione della pizza.
In particolare:

- Le pizze, è l'insieme di tutte le opzioni disponibili fornite dalle pizzerie.
- La pizzeria, comprende al suo interno i pizzaioli che creano la pizza.
- Gli ingredienti, comprende tutti gli ingredienti che fanno parte delle pizze, andando ad escludere unicamente gli ingredienti che sono alla base dell'impasto (farina, acqua, ecc)
- Le tipologie di pizza, comprende i vari tipi di pizze disponibili (Napoletana, al taglio, al tegamino).
- I processi, ovvero gli steps che devono essere seguiti per la creazione dell'impasto.

A queste classi poi vengono aggiunte anche delle specializzazioni per riuscire a definire al meglio il dominio.

Fonti

- Per la definizione degli steps che devono essere eseguite per la creazione di un ottimo impasto ho tenuto in considerazione questa fonte: https://www.waldkorn.it/processo-di-panificazione-pane/

- Per la definizione delle intolleranze alimentari ho tenuto in considerazione il seguente link: https://www.my-personaltrainer.it/nutrizione/allergie-alimentari5.html

- Per la definizione degli ingredienti, ho tenuto in considerazione il seguente link: https://en.wikipedia.org/wiki/Pizza_in_the_United_States

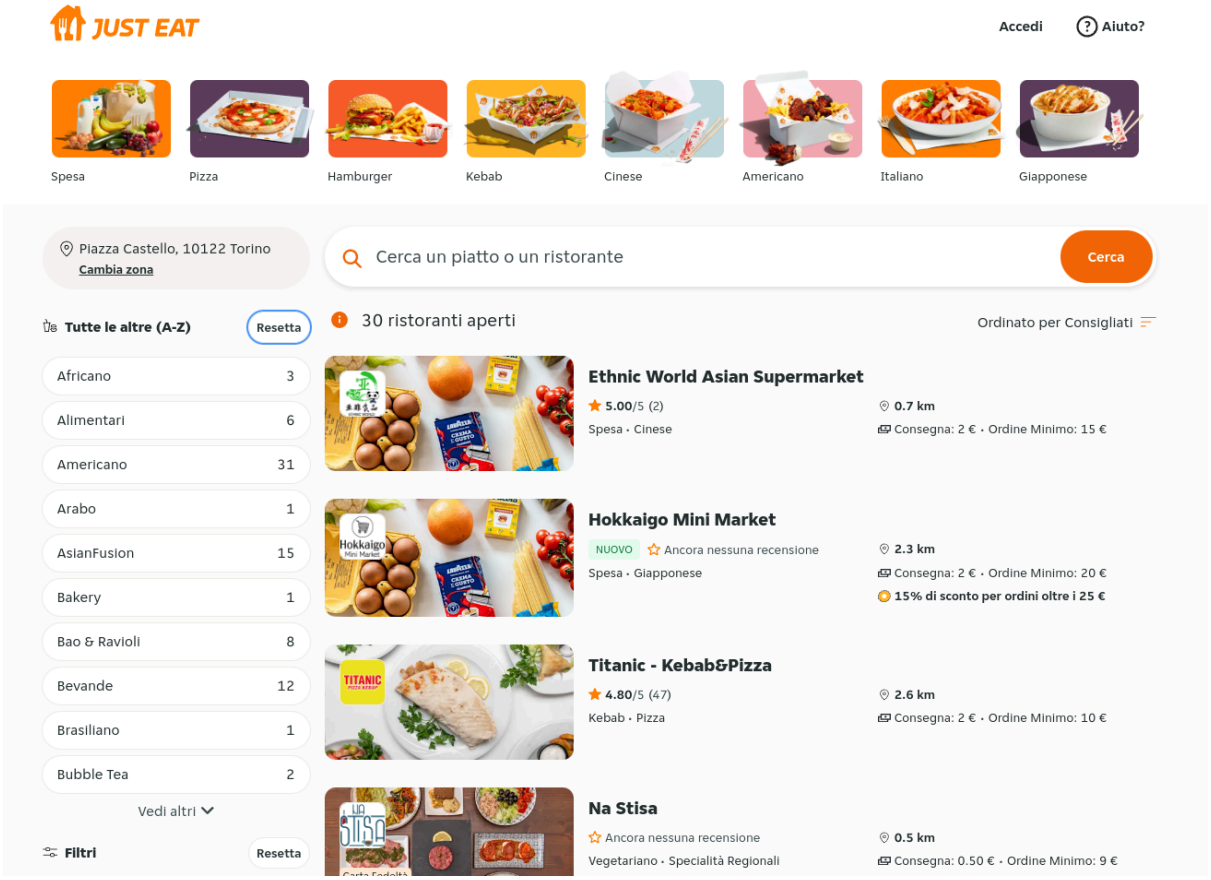
Competency questions

Le domande di competenza del dominio sono tutte quelle domande che un utente si pone per la scelta della migliore pizza in quel momento, come vedremo poi all'azione con le query, l'ontologia ha lo scopo di rispondere alle seguenti domande:

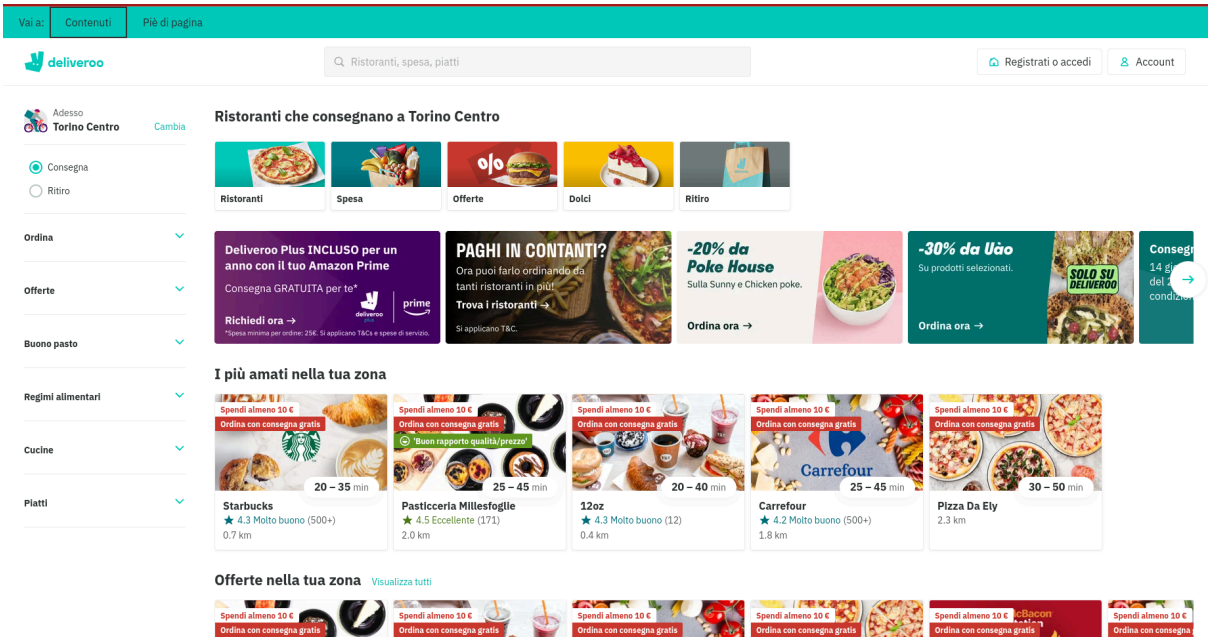
- Individuare tutte le pizze che hanno nella lista degli ingredienti uno o più a scelta dell'utente.
- Individuare la lista di tutti i pizzaioli che lavorano in una determinata pizzeria.
- Riuscire a definire il numero totale di pizze disponibili all'acquisto.
- Individuare tutte le pizze che risultano edibili da persone con intolleranze alimentari.
- Individuare tutti i processi produttivi che stanno dietro alla creazione di una pizza.

Documentazione del dominio

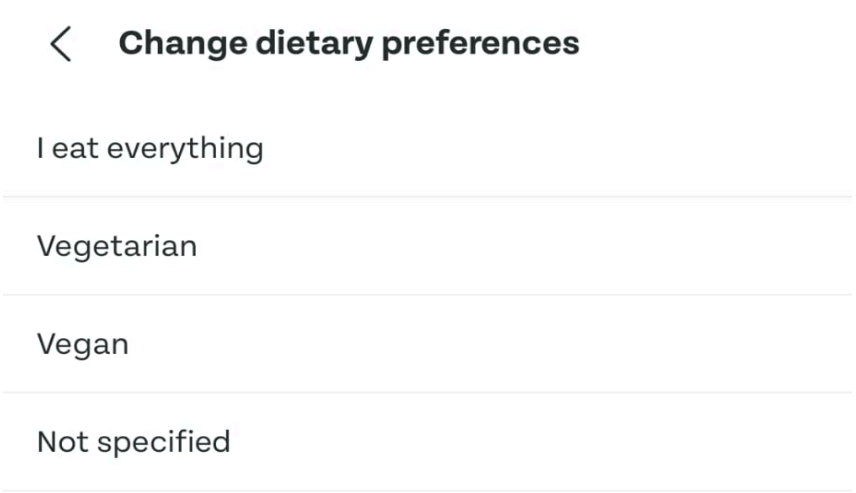
L'ontologia creata ha come scopo principale quello di individuare tutte le pizze che hanno determinate caratteristiche inserite dall'utente.
Come esempio ho tenuto in considerazione i tre servizi più grandi che si occupano di cibo ovvero JustEat, Deliveroo e TooGoodToGo.
Iniziamo con JustEat, l'homepage ha qualche caratteristica che può risultare coerente con lo scopo dell'ontologia, ovvero la barra di ricerca, anche se in questo caso si può ricercare solamente un ristorante o un piatto, e una lista di possibili ristoranti da cui scegliere.
Essendo PizzaOntology, un'ontologia interamente incentrata sulla pizza, gli elementi che ho potuto tenere in considerazione di questo servizio, sono stati solamente la barra di ricerca, che nel mio caso può essere utilizzata per la ricerca di ingredienti, pizze, pizzerie, ecc. e la visualizzazione di un insieme di possibilità.



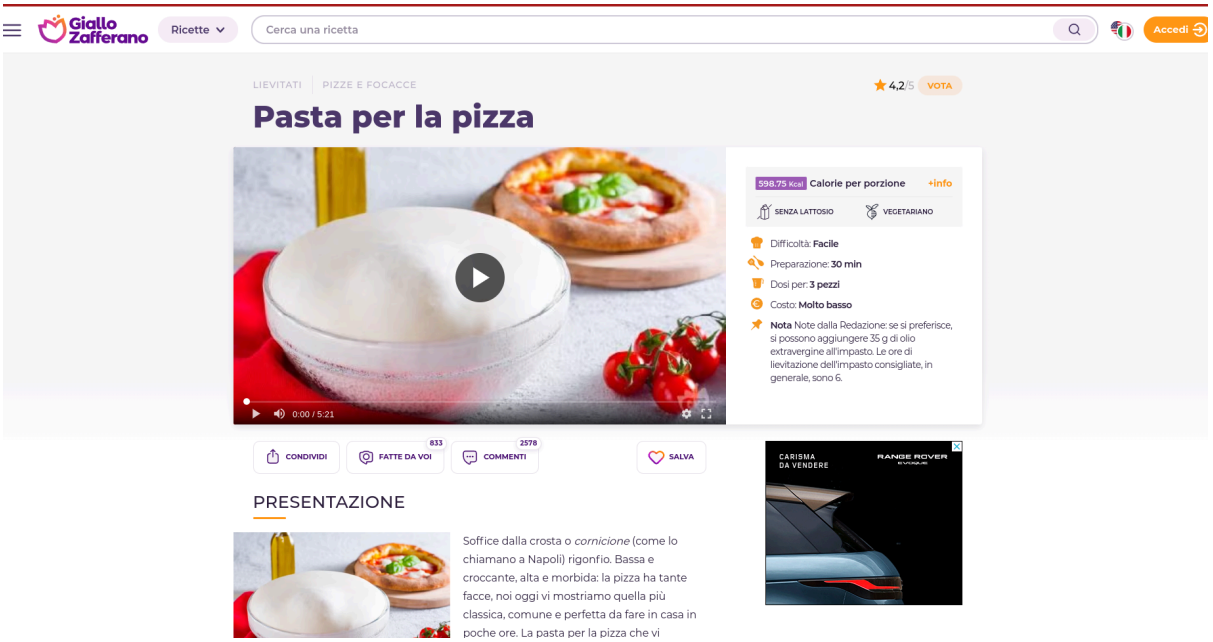
Per quanto riguarda Deliveroo, invece, anche in questo caso è presente una schermata simile a quella di JustEat, ma sono presenti più filtri che possono essere inseriti, cosa che ho molto apprezzato e di cui ho tenuto conto per l'inserimento dei filtri nella ricerca delle pizze.
Su Deliveroo infatti è anche possibile inserire il filtro della cucina vegetariana, che ho tenuto presente per la parte di filtro per quanto riguarda le intolleranze alimentari che ho inserito.



Infine c'è TooGoodToGo, di cui mi è piaciuto il fatto che si possono specificare delle preferenze alimentari direttamente nel profilo utente, così da poter filtrare i risultati proponendo all'utente solamente le opzioni che risultano coerenti, questo aspetto l'ho tenuto in considerazione per l'introduzione della relazione tra utente e intolleranze alimentari.



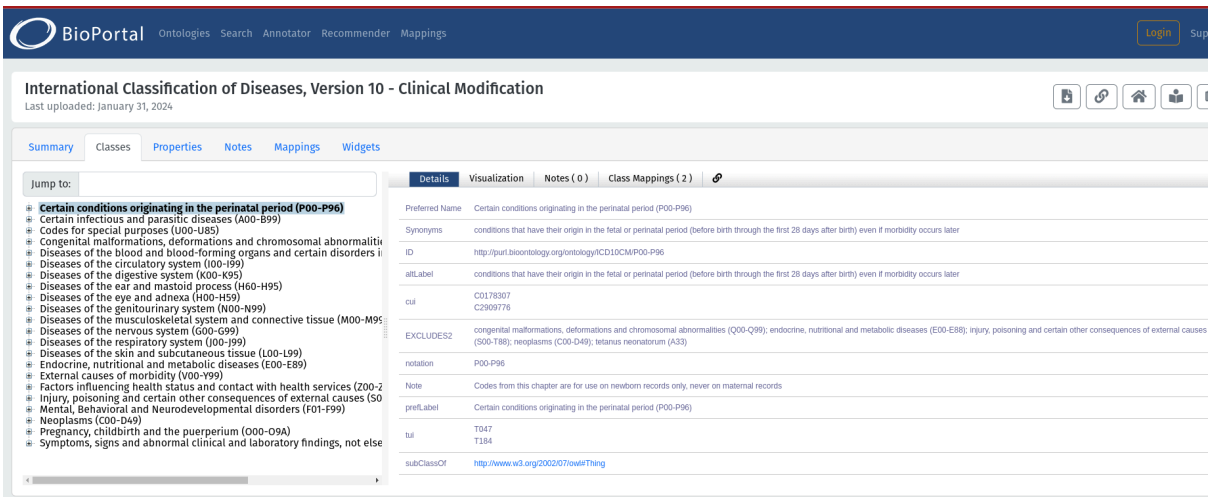
Per quanto riguarda invece la visualizzazione della pizza e i principali step che sono necessari per farla ho preso spunto da Giallo Zafferano



In cui sono visualizzate tutte le informazioni riguardanti alla pizza, nel mio caso ho adattato l'idea andando a rimuovere tutta la parte di ricetta, andando a mantenere solamente gli aspetti che mi interessavano come il prezzo o il ristorante che crea la pizza, e integrando con il numero di steps fondamentali per la preparazione e quali sono questi step.

Le principali ontologia che ho tenuto in considerazione per la creazione di PizzaOntology sono state:

- https://w3id.org/MON/person.owl, per tutti gli aspetti che riguardano la Persona, quindi sia l'entità in sé, sia le proprietà come birthDate o firstName.
- http://purl.bioontology.org/ontology/ICD10CM, per quanto riguarda le intolleranze che sono andato ad inserire ho preso riferimento e mi sono allineato al thesauro "International Classification of Diseases".

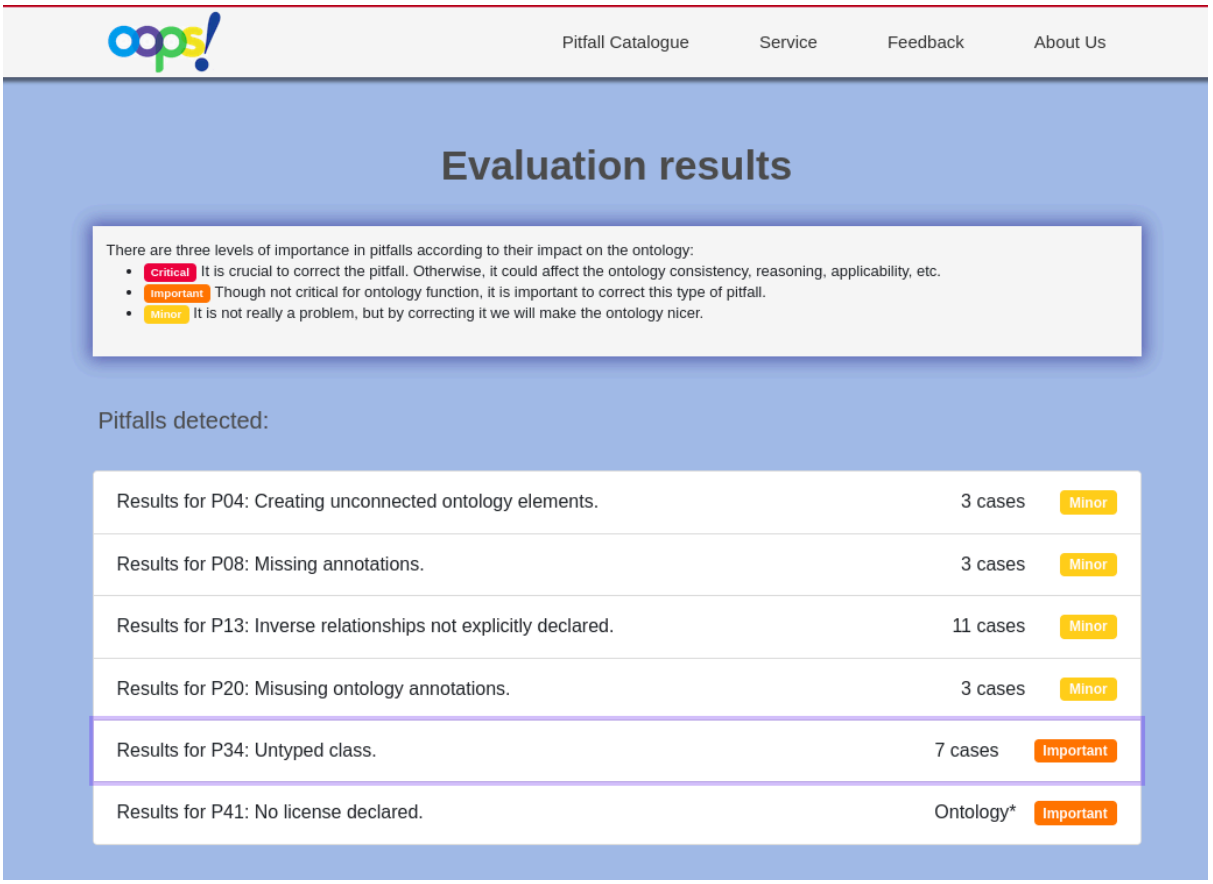


In questo caso, per l'allineamento, ho utilizzato la proprietà owl:equivalentClass perché volevo che le classi importate e le classi che ho inserito nella mia ontologia

fossero del tutto e per tutto identiche e quindi interscambiabili tra loro senza perdita di significato.

OntOlogy Pitfall Scanner (OOPS)

Ho utilizzato il tool OOPS per analizzare l'ontologia creata cercando così di individuare falle, criticità o problemi.
Per fare questo ho caricato l'ontologia in formato RDF/XML direttamente sul sito web, e questo mi ha restituito la seguente risposta.



I problemi individuati risultano essere tutti di minore importanza andando in particolare a segnalare la mancanza di proprietà inverse.

Gli unici che si possono definire importanti sono la mancanza di una licenza dichiarata nell'ontologia e le classi senza tipo che però risultano essere quelle dichiarate da swrl, come nell'immagine sotto riportata.

Results for P34: Untyped class.

7 cases

Important

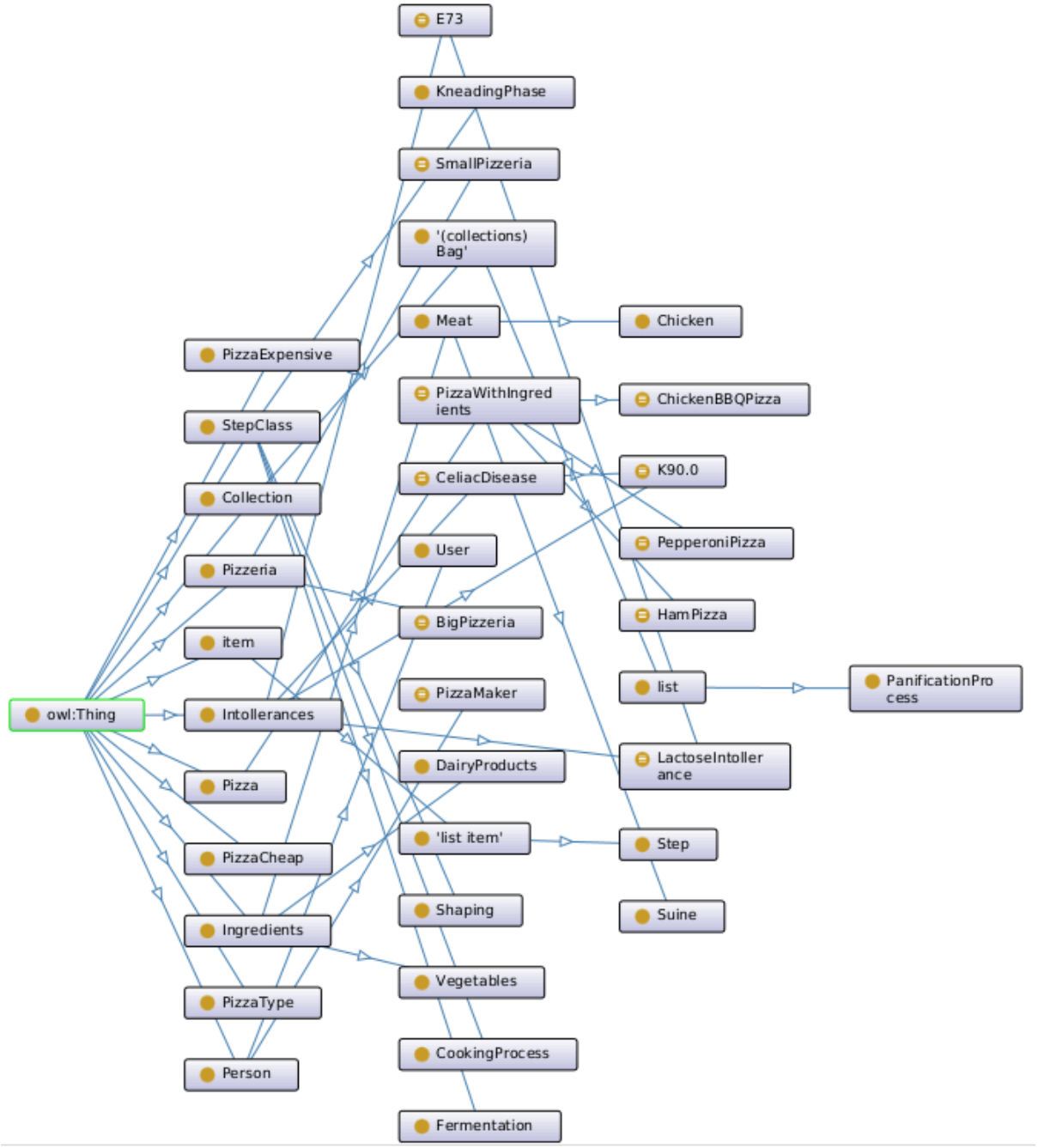
An ontology element is used as a class without having been explicitly declared as such using the primitives owl:Class or rdfs:Class. This pitfall is related with the common problems listed in [8].

• This pitfall appears in the following elements:
› http://www.w3.org/2003/11/swrl#AtomList
› http://www.w3.org/2003/11/swrl#DatavaluedPropertyAtom
› http://www.w3.org/2003/11/swrl#Imp
› http://www.w3.org/2003/11/swrl#IndividualPropertyAtom
› http://www.w3.org/2003/11/swrl#ClassAtom
› http://www.w3.org/2003/11/swrl#Variable
› http://www.w3.org/2003/11/swrl#BuiltinAtom

Visualizzazione

Tassonomia delle classi

Ho utilizzato il plug-in OntoGraph per la visualizzazione delle classi sotto forma di grafico, lo riporto nell'immagine di seguito.



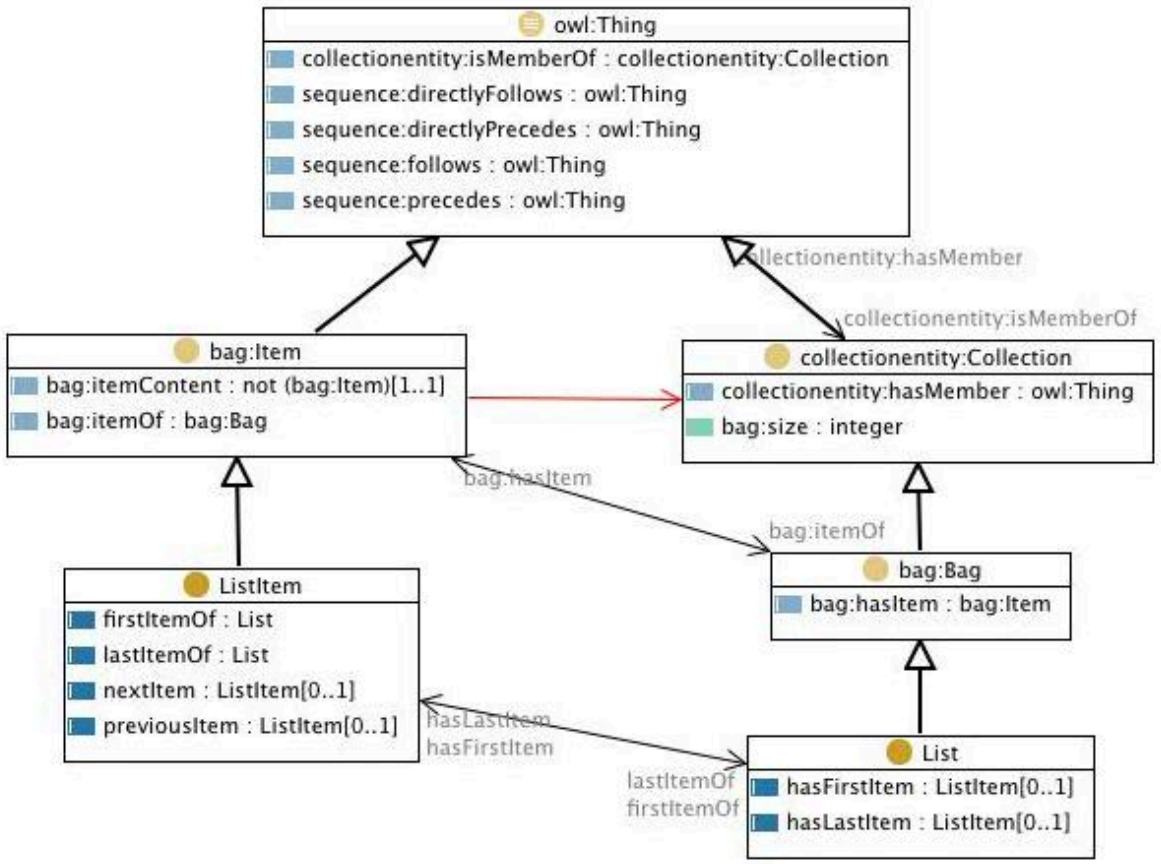
Templates utilizzati

Nell'ontologia ho utilizzato l'ODP List per riuscire a rappresentare il processo di panificazione della pizza che è formato da 4 step ordinati:

1. Impastamento

2. Formatura
3. Fermentazione
4. Cottura

La componente di sequenza è stata modellata attraverso le proprietà directlyPrecedes e directlyFollows dell'ontologia http://www.ontologydesignpatterns.org/cp/owl/sequence.owl

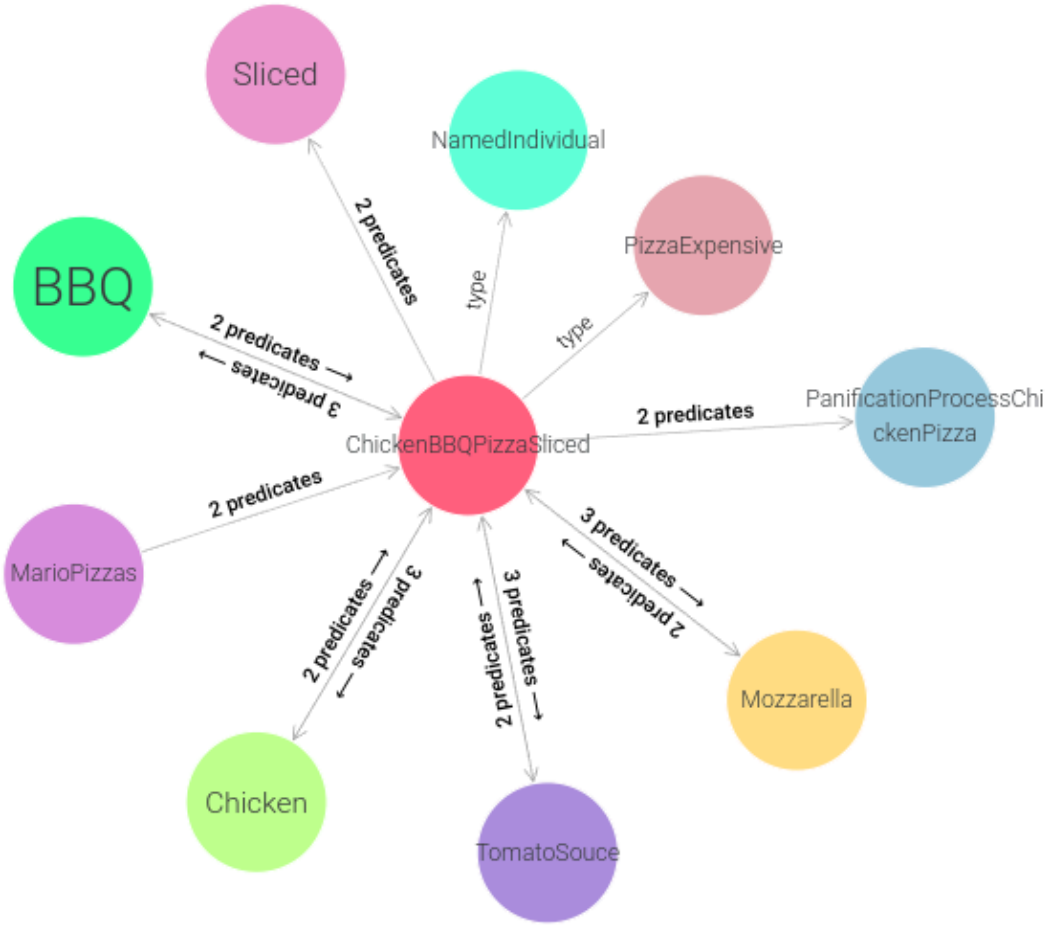


Triple in formato tabella

Attraverso il tool GraphDB ho creato una tabella di triple riguardanti la tipologia di pizza "ChickenBBQPizzaSliced" in cui vengono visualizzate alcune delle relazioni che ha con altre classi, come ad esempio hasIngredients e alcune delle sue data propriety, come ad esempio hasPrice.

	subject	predicate	object
1	:ChickenBBQPizzaSliced	:chickenBBQPizzaHasIngredients	:BBQ
2	:ChickenBBQPizzaSliced	:chickenBBQPizzaHasIngredients	:Chicken
3	:ChickenBBQPizzaSliced	:chickenBBQPizzaHasIngredients	:Mozzarella
4	:ChickenBBQPizzaSliced	:chickenBBQPizzaHasIngredients	:TomatoSouce
5	:ChickenBBQPizzaSliced	:hasIngredients	:BBQ
6	:ChickenBBQPizzaSliced	:hasIngredients	:Chicken
7	:ChickenBBQPizzaSliced	:hasIngredients	:Mozzarella
8	:ChickenBBQPizzaSliced	:hasIngredients	:TomatoSouce
9	:ChickenBBQPizzaSliced	:hasPanificationProcess	:PanificationProcessChickenPizza
10	:ChickenBBQPizzaSliced	:hasPrice	"12"^^xsd:integer
11	:ChickenBBQPizzaSliced	:hasType	:Sliced
12	:ChickenBBQPizzaSliced	:isGlutenFree	"true"^^xsd:boolean
13	:ChickenBBQPizzaSliced	:isLactoseFree	"false"^^xsd:boolean
14	:ChickenBBQPizzaSliced	:isPizzaVegetarian	"false"^^xsd:boolean
15	:ChickenBBQPizzaSliced	rdf:type	:PizzaExpensive
16	:ChickenBBQPizzaSliced	rdf:type	owl:NamedIndividual
17	:ChickenBBQPizzaSliced	rdfs:comment	"A Sliced pizza with chicken and BBQ"@en

Ho inoltre creato, sempre grazie al tool GraphDB un grafo sempre riguardante ChickenBBQPizzaSliced, dove essenzialmente vengono riportate le stesse relazioni che trovavamo nella tabella, ma in formato di grafo.



Ontologia in formato Turtle

@prefix : <http://www.semanticweb.org/federico/ontologies/2024/1/pizza/> .
@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#> .
@prefix deseases: <http://purl.bioontology.org/ontology/ICD10CM/> .
@base <http://www.semanticweb.org/federico/ontologies/2024/1/pizza/> .

<http://www.semanticweb.org/federico/ontologies/2024/1/pizza> rdf:type owl:Ontology ;
owl:imports
<http://www.ontologydesignpatterns.org/cp/owl/list.owl> ;
<http://purl.org/dc/elements/1.1/creator> "Federico
Guidazzi"@en ;
<http://purl.org/dc/elements/1.1/date>
"2024-01-01T00:00:00"^^xsd:dateTime ;
<http://purl.org/dc/elements/1.1/description> "This is
an ontology regarding pizza and all the aspects connected to it"@en ;

<http://purl.org/dc/elements/1.1/title>
"PizzaOntology"@en ;

<http://purl.org/vocab/vann/preferredNamespacePrefix> "pizzaOntology"@en ;
<http://purl.org/vocab/vann/preferredNamespaceUri>
"http://www.semanticweb.org/pizzaOntology"@en ;
rdfs:label "PizzaOntology"@en .

###
Annotation properties
###

http://purl.org/dc/elements/1.1/creator
<http://purl.org/dc/elements/1.1/creator> rdf:type owl:AnnotationProperty .

http://purl.org/dc/elements/1.1/date
<http://purl.org/dc/elements/1.1/date> rdf:type owl:AnnotationProperty .

http://purl.org/dc/elements/1.1/description
<http://purl.org/dc/elements/1.1/description> rdf:type owl:AnnotationProperty .

http://purl.org/dc/elements/1.1/title
<http://purl.org/dc/elements/1.1/title> rdf:type owl:AnnotationProperty .

http://purl.org/vocab/vann/preferredNamespacePrefix
<http://purl.org/vocab/vann/preferredNamespacePrefix> rdf:type owl:AnnotationProperty .

http://purl.org/vocab/vann/preferredNamespaceUri
<http://purl.org/vocab/vann/preferredNamespaceUri> rdf:type owl:AnnotationProperty .

http://swrl.stanford.edu/ontologies/3.3/swrla.owl#isRuleEnabled
<http://swrl.stanford.edu/ontologies/3.3/swrla.owl#isRuleEnabled> rdf:type
owl:AnnotationProperty .

###
Object Properties
###

http://www.ontologydesignpatterns.org/cp/owl/list.owl#hasFirstItem
<http://www.ontologydesignpatterns.org/cp/owl/list.owl#hasFirstItem> rdfs:range
<http://www.ontologydesignpatterns.org/cp/owl/list.owl#ListItem> .

```
###  http://www.ontologydesignpatterns.org/cp/owl/list.owl#hasLastItem
<http://www.ontologydesignpatterns.org/cp/owl/list.owl#hasLastItem> rdfs:range
<http://www.ontologydesignpatterns.org/cp/owl/list.owl#ListItem> .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/chickenBBQPizzaHasIngredie
nts
:chickenBBQPizzaHasIngredients rdf:type owl:ObjectProperty ;
                        rdfs:subPropertyOf :hasIngredients ;
                        rdfs:domain :Pizza ;
                        rdfs:range [ rdf:type owl:Class ;
                                     owl:oneOf ( :BBQ
                                                 :Chicken
                                                 :Mozzarella
                                                 :TomatoSouce
                                               )
                                   ] ;
                        rdfs:comment "Propriety that associate a chickeBBQPizza with its
ingredients"@en ;
                        rdfs:label "chickenBBQPizzaHasIngredients"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/hamPizzaHasIngredients
:hamPizzaHasIngredients rdf:type owl:ObjectProperty ;
                        rdfs:subPropertyOf :hasIngredients ;
                        rdfs:domain :Pizza ;
                        rdfs:range [ rdf:type owl:Class ;
                                     owl:oneOf ( :Ham
                                                 :Mozzarella
                                                 :TomatoSouce
                                               )
                                   ] ;
                        rdfs:comment "Propriety that associate a hamPizza with its ingredients"@en ;
                        rdfs:label "hamPizzaHasIngredients"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/hasEmployee
:hasEmployee rdf:type owl:ObjectProperty ;
             rdfs:subPropertyOf owl:topObjectProperty ;
             owl:inverseOf :works ;
             rdfs:domain :Pizzeria ;
             rdfs:range :PizzaMaker ;
             rdfs:comment "Propriety that associate a worplace with its employees"@en ;
             rdfs:label "hasEmployee"@en .
```

```
### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/hasIngredients
:hasIngredients rdf:type owl:ObjectProperty ;
                rdfs:subPropertyOf owl:topObjectProperty ;
                owl:inverseOf :isInPizza ;
                rdfs:domain :Pizza ;
                rdfs:range :Ingredients ;
                rdfs:comment "Propriety that associate a pizza with its ingredients"@en ;
                rdfs:label "hasIngredients"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/hasIntollerance
:hasIntollerance rdf:type owl:ObjectProperty ;
                 rdfs:domain :User ;
                 rdfs:range :Intolerances ;
                 rdfs:comment "Propriety that associate a person with its diseases"@en ;
                 rdfs:label "hasIntollerances"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/hasPanificationProcess
:hasPanificationProcess rdf:type owl:ObjectProperty ;
                        rdfs:subPropertyOf owl:topObjectProperty ;
                        rdfs:domain :Pizza ;
                        rdfs:range :PanificationProcess ;
                        rdfs:comment "Propriety that associate a pizza with its panification
process"@en ;
                        rdfs:label "hasPanificationProcess"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/hasType
:hasType rdf:type owl:ObjectProperty ;
         rdfs:subPropertyOf owl:topObjectProperty ;
         rdfs:domain :Pizza ;
         rdfs:range :PizzaType ;
         rdfs:comment "Propriety that associate a Pizza with its Type"@en ;
         rdfs:label "hasType"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/isInPizza
:isInPizza rdf:type owl:ObjectProperty ;
           rdfs:subPropertyOf owl:topObjectProperty ;
           rdfs:domain :Ingredients ;
           rdfs:range :Pizza ;
           rdfs:comment "Propriety that associate an ingredient with its pizza"@en ;
           rdfs:label "isInPizza"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/likesIngredient
```

```
:likesIngredient rdf:type owl:ObjectProperty ;
                 rdfs:subPropertyOf owl:topObjectProperty ;
                 rdfs:domain :User ;
                 rdfs:range :Ingredients ;
                 rdfs:comment "Propriety that associate a person with ian ingredient"@en ;
                 rdfs:label "likesIngredient"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/likesPizza
:likesPizza rdf:type owl:ObjectProperty ;
            rdfs:domain :User ;
            rdfs:range :Pizza ;
            owl:propertyChainAxiom ( :likesIngredient
                                     :isInPizza
                                   ) ;
            rdfs:comment "Propriety that associate a person with a pizza using the ingredients of
the pizza"@en ;
            rdfs:label "likesPizza"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/makes
:makes rdf:type owl:ObjectProperty ;
       rdfs:subPropertyOf owl:topObjectProperty ;
       rdfs:domain :Pizzeria ;
       rdfs:range :Pizza ;
       rdfs:comment "Propriety that associate a Pizzeria with its a pizza"@en ;
       rdfs:label "makes"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/pepperoniPizzaHasIngredients
:pepperoniPizzaHasIngredients rdf:type owl:ObjectProperty ;
                              rdfs:subPropertyOf :hasIngredients ;
                              rdfs:domain :Pizza ;
                              rdfs:range [ rdf:type owl:Class ;
                                           owl:oneOf ( :Mozzarella
                                                       :Pepperoni
                                                       :TomatoSouce
                                                     )
                                         ] ;
                              rdfs:comment "Propriety that associate a pepperoniPizza with its
ingredients"@en ;
                              rdfs:label "pepperoniPizzaHasIngredients"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/pizzeriaMakesPizzaWithType
:pizzeriaMakesPizzaWithType rdf:type owl:ObjectProperty ;
```

```
                    rdfs:subPropertyOf owl:topObjectProperty ;
                    rdfs:domain :Pizzeria ;
                    rdfs:range :PizzaType ;
                    owl:propertyChainAxiom ( :makes
                                             :hasType
                                           ) ;
                    rdfs:comment "Propriety that associate a Pizzeria with a type of pizza"@en
;
                    rdfs:label "pizzeriaMakesPizzaWithType"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/works
:works rdf:type owl:ObjectProperty ;
      rdfs:subPropertyOf owl:topObjectProperty ;
      rdf:type owl:FunctionalProperty ;
      rdfs:domain :PizzaMaker ;
      rdfs:range :Pizzeria ;
      rdfs:comment "Propriety that associate an employee with his workplace"@en ;
      rdfs:label "works"@en .


#################################################################
#    Data properties
#################################################################

###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/hasName
:hasName rdf:type owl:DatatypeProperty ;
        rdfs:subPropertyOf owl:topDataProperty ;
        rdfs:domain :Pizzeria ;
        rdfs:range xsd:string ;
        rdfs:comment "The name of the pizzeria"@en ;
        rdfs:label "hasName"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/hasPrice
:hasPrice rdf:type owl:DatatypeProperty ;
         rdfs:subPropertyOf owl:topDataProperty ;
         rdfs:domain :Pizza ;
         rdfs:range xsd:int ;
         rdfs:comment "Propriety that gives associate a Pizza with its price"@en ;
         rdfs:label "hasPrice"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/isGlutenFree
:isGlutenFree rdf:type owl:DatatypeProperty ;
            rdfs:domain :Pizza ;
            rdfs:range xsd:boolean ;
            rdfs:comment "Propriety that associate a pizza with its gluten freeness"@en ;
```

```
        rdfs:label "isGlutenFree"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/isLactoseFree
:isLactoseFree rdf:type owl:DatatypeProperty ;
           rdfs:domain :Pizza ;
           rdfs:range xsd:boolean ;
           rdfs:comment "The value is true if the pizza is lactose free"@en ;
           rdfs:label "isLactoseFree"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/isPizzaVegetarian
:isPizzaVegetarian rdf:type owl:DatatypeProperty ,
                           owl:FunctionalProperty ;
              rdfs:domain :Pizza ;
              rdfs:range xsd:boolean ;
              rdfs:comment "The prorpriety that links a pizza with a boolean that indicates if a
pizza is vegetarian"@en ;
              rdfs:label "isPizzaVegetarian"@en .


###  https://w3id.org/MON/person.owl#birthDate
<https://w3id.org/MON/person.owl#birthDate> rdf:type owl:DatatypeProperty ;
                                rdfs:subPropertyOf owl:topDataProperty ;
                                rdfs:domain <https://w3id.org/MON/person.owl#Person> ;
                                rdfs:range xsd:dateTime ;
                                rdfs:comment "Propriety that associate a person with its birth
date"@en ;
                                rdfs:label "birthDate"@en .


###  https://w3id.org/MON/person.owl#firstName
<https://w3id.org/MON/person.owl#firstName> rdf:type owl:DatatypeProperty ;
                                rdfs:subPropertyOf owl:topDataProperty ;
                                rdfs:domain <https://w3id.org/MON/person.owl#Person> ;
                                rdfs:range xsd:string ;
                                rdfs:comment "Propriety that associate a person with its first
name"@en ;
                                rdfs:label "firstName"@en .


#################################################################
#    Classes
#################################################################

###  http://purl.bioontology.org/ontology/ICD10CM/E73
deseases:E73 rdf:type owl:Class ;
          owl:equivalentClass :LactoseIntollerance ;
```

```
        rdfs:subClassOf :Intolerances ;
        rdfs:comment "Lactose intolerance is caused by a lessened ability or a complete
inability to digest lactose, a sugar found in dairy products."@en ;
        rdfs:label "E73"@en .


###  http://purl.bioontology.org/ontology/ICD10CM/K90.0
deseases:K90.0 rdf:type owl:Class ;
          owl:equivalentClass :CeliacDisease ;
          rdfs:subClassOf :Intolerances ;
          rdfs:comment "Celiac disease is an illness caused by an immune reaction to eating
gluten."@en ;
          rdfs:label "K90.0"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/BigPizzeria
:BigPizzeria rdf:type owl:Class ;
        owl:equivalentClass [ owl:intersectionOf ( :Pizzeria
                                                   [ rdf:type owl:Restriction ;
                                                     owl:onProperty :hasEmployee ;
                                                     owl:minQualifiedCardinality
"3"^^xsd:nonNegativeInteger ;
                                                     owl:onClass :PizzaMaker
                                                   ]
                                                 ) ;
                              rdf:type owl:Class
                            ] ;
        rdfs:subClassOf :Pizzeria ,
                        [ owl:intersectionOf ( :Pizzeria
                                               [ rdf:type owl:Restriction ;
                                                 owl:onProperty :hasEmployee ;
                                                 owl:minQualifiedCardinality "3"^^xsd:nonNegativeInteger ;
                                                 owl:onClass :PizzaMaker
                                               ]
                                             ) ;
                          rdf:type owl:Class
                        ] ,
                        [ rdf:type owl:Restriction ;
                          owl:onProperty :hasEmployee ;
                          owl:minQualifiedCardinality "3"^^xsd:nonNegativeInteger ;
                          owl:onClass :PizzaMaker
                        ] ;
        owl:disjointWith :SmallPizzeria ;
        rdfs:comment "A Pizzeria with many Employees"@en ;
        rdfs:label "BigPizzeria"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/CeliacDisease
```

```
:CeliacDisease rdf:type owl:Class ;
               rdfs:subClassOf :Intolerances ;
               rdfs:comment "Celiac disease is an illness caused by an immune reaction to eating
gluten."@en ;
               rdfs:label "CeliacDisease"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Chicken
:Chicken rdf:type owl:Class ;
         rdfs:subClassOf :Meat ;
         owl:disjointWith :Suine .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/ChickenBBQPizza
:ChickenBBQPizza rdf:type owl:Class ;
                 owl:equivalentClass [ rdf:type owl:Restriction ;
                                       owl:onProperty :chickenBBQPizzaHasIngredients ;
                                       owl:qualifiedCardinality "4"^^xsd:nonNegativeInteger ;
                                       owl:onClass :Ingredients
                                     ] ;
                 rdfs:subClassOf :PizzaWithIngredients ;
                 rdfs:comment "A Pizza with chicken, BBQ, Tomato Souce, Mozzarella"@en ;
                 rdfs:label "ChickenBBQPizza"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/CookingProcess
:CookingProcess rdf:type owl:Class ;
                rdfs:subClassOf :StepClass ;
                rdfs:comment "A step to make a pizza dough, in which the dough is cooked."@en ;
                rdfs:label "CookingProcess"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/DairyProducts
:DairyProducts rdf:type owl:Class ;
               rdfs:subClassOf :Ingredients ;
               rdfs:comment "A set of product made of milk"@en ;
               rdfs:label "DairyProducts"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Fermentation
:Fermentation rdf:type owl:Class ;
              rdfs:subClassOf :StepClass ;
              rdfs:comment "A step to make a pizza dough, in wich the dough ferments."@en ;
              rdfs:label "Fermentation"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/HamPizza
:HamPizza rdf:type owl:Class ;
```

```
        owl:equivalentClass [ rdf:type owl:Restriction ;
                              owl:onProperty :hamPizzaHasIngredients ;
                              owl:qualifiedCardinality "3"^^xsd:nonNegativeInteger ;
                              owl:onClass :Ingredients
                            ] ;
        rdfs:subClassOf :PizzaWithIngredients .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Ingredients
:Ingredients rdf:type owl:Class ;
           rdfs:comment "A set of elements to put on the pizza"@en ;
           rdfs:label "Ingredients"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Intolerances
:Intolerances rdf:type owl:Class ;
            rdfs:comment "A set of deseases."@en ;
            rdfs:label "Intollerances"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/KneadingPhase
:KneadingPhase rdf:type owl:Class ;
             rdfs:subClassOf :StepClass ;
             rdfs:comment "A step to make a pizza dough, in wich the dough is worked to form
a smooth and cohesive mass."@en ;
             rdfs:label "KneadingPhase"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/LactoseIntollerance
:LactoseIntollerance rdf:type owl:Class ;
                   rdfs:subClassOf :Intolerances ;
                   rdfs:comment "Lactose intolerance is caused by a lessened ability or a
complete inability to digest lactose, a sugar found in dairy products."@en ;
                   rdfs:label "LactoseIntollerance"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Meat
:Meat rdf:type owl:Class ;
      rdfs:subClassOf :Ingredients ;
      rdfs:comment "A set of ingredients of animal origin"@en ;
      rdfs:label "Meat"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PanificationProcess
:PanificationProcess rdf:type owl:Class ;
                   rdfs:subClassOf <http://www.ontologydesignpatterns.org/cp/owl/list.owl#List> ;
                   rdfs:comment "The process to make dough."@en ;
                   rdfs:label "PanificationProcess"@en .
```

```
### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PepperoniPizza
:PepperoniPizza rdf:type owl:Class ;
            owl:equivalentClass [ rdf:type owl:Restriction ;
                                  owl:onProperty :pepperoniPizzaHasIngredients ;
                                  owl:qualifiedCardinality "3"^^xsd:nonNegativeInteger ;
                                  owl:onClass :Ingredients
                                ] ;
            rdfs:subClassOf :PizzaWithIngredients .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Pizza
:Pizza rdf:type owl:Class ;
      rdfs:comment "Famous italian dish"@en ;
      rdfs:label "Pizza"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PizzaCheap
:PizzaCheap rdf:type owl:Class ;
          owl:disjointWith :PizzaExpensive ;
          rdfs:comment "A pizza which price is under 11"@en ;
          rdfs:label "PizzaCheap"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PizzaExpensive
:PizzaExpensive rdf:type owl:Class ;
            rdfs:comment "A pizza which price is over 11"@en ;
            rdfs:label "PizzaExpensive"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PizzaMaker
:PizzaMaker rdf:type owl:Class ;
          owl:equivalentClass [ rdf:type owl:Restriction ;
                                owl:onProperty :works ;
                                owl:someValuesFrom :Pizzeria
                              ] ;
          rdfs:subClassOf <https://w3id.org/MON/person.owl#Person> ;
          rdfs:comment "A person thats work is to make Pizza"@en ;
          rdfs:label "PizzaMaker"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PizzaType
:PizzaType rdf:type owl:Class ;
          rdfs:comment "Represent pizzas type"@en ;
          rdfs:label "PizzaType"@en .
```

```
###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PizzaWithIngredients
:PizzaWithIngredients rdf:type owl:Class ;
                      owl:equivalentClass [ owl:intersectionOf ( :Pizza
                                                                 [ rdf:type owl:Restriction ;
                                                                   owl:onProperty :hasIngredients ;
                                                                   owl:someValuesFrom :Ingredients
                                                                 ]
                                                               ) ;
                                            rdf:type owl:Class
                                          ] ;
                      rdfs:subClassOf :Pizza ;
                      rdfs:comment "A pizza with at least one ingredient"@en ;
                      rdfs:label "PizzaWithIngredients"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Pizzeria
:Pizzeria rdf:type owl:Class ;
          rdfs:comment "A place where it is possible to buy a Pizza"@en ;
          rdfs:label "Pizzeria"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Shaping
:Shaping rdf:type owl:Class ;
         rdfs:subClassOf :StepClass ;
         rdfs:comment "A step to make a pizza dough, in wich the dough is shaped."@en ;
         rdfs:label "Shaping"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/SmallPizzeria
:SmallPizzeria rdf:type owl:Class ;
               owl:equivalentClass [ owl:intersectionOf ( :Pizzeria
                                                          [ rdf:type owl:Restriction ;
                                                            owl:onProperty :hasEmployee ;
                                                            owl:maxQualifiedCardinality
"2"^^xsd:nonNegativeInteger ;
                                                            owl:onClass :PizzaMaker
                                                          ]
                                                        ) ;
                                     rdf:type owl:Class
                                   ] ;
               rdfs:subClassOf :Pizzeria ,
                               [ owl:intersectionOf ( :Pizzeria
                                                      [ rdf:type owl:Restriction ;
                                                        owl:onProperty :hasEmployee ;
                                                        owl:maxQualifiedCardinality "2"^^xsd:nonNegativeInteger
;
                                                        owl:onClass :PizzaMaker
                                                      ]
```

```
                                ) ;
                        rdf:type owl:Class
                      ] ,
                      [ rdf:type owl:Restriction ;
                        owl:onProperty :hasEmployee ;
                        owl:maxQualifiedCardinality "2"^^xsd:nonNegativeInteger ;
                        owl:onClass :PizzaMaker
                      ] ;
            rdfs:comment "A pizzeria with at max 2 PizzaMakers"@en ;
            rdfs:label "SmallPizzeria"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step
:Step rdf:type owl:Class ;
     rdfs:subClassOf <http://www.ontologydesignpatterns.org/cp/owl/list.owl#ListItem> ;
     rdfs:comment "An element of the collection of steps to make a pizza dough"@en ;
     rdfs:label "Step"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/StepClass
:StepClass rdf:type owl:Class ;
          owl:disjointUnionOf ( :CookingProcess
                        :Fermentation
                        :KneadingPhase
                        :Shaping
                      ) ;
          rdfs:comment "A step to make a pizza dough"@en ;
          rdfs:label "StepClass"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Suine
:Suine rdf:type owl:Class ;
       rdfs:subClassOf :Meat ;
       rdfs:comment "Suine"@en ;
       rdfs:label "Suine"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/User
:User rdf:type owl:Class ;
     rdfs:subClassOf <https://w3id.org/MON/person.owl#Person> ;
     rdfs:comment "A person that wants to buy a Pizza"@en ;
     rdfs:label "User"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Vegetables
:Vegetables rdf:type owl:Class ;
           rdfs:subClassOf :Ingredients ;
           rdfs:comment "Vegetables"@en ;
```

```
        rdfs:label "Vegetables"@en .


###  https://w3id.org/MON/person.owl#Person
<https://w3id.org/MON/person.owl#Person> rdf:type owl:Class ;
                                         rdfs:comment "a Human beeing"@en ;
                                         rdfs:label "Person"@en .


#################################################################
#    Individuals
#################################################################

###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Anna
:Anna rdf:type owl:NamedIndividual ,
              :User ;
      :likesIngredient :Pepperoni ;
      <https://w3id.org/MON/person.owl#birthDate> "2000-01-01T00:00:00"^^xsd:dateTime ;
      <https://w3id.org/MON/person.owl#firstName> "Anna" ;
      rdfs:comment "A user of the ontology who likes Pepperoni"@en ;
      rdfs:label "Anna"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/BBQ
:BBQ rdf:type owl:NamedIndividual ,
             :Ingredients ,
             [ rdf:type owl:Class ;
               owl:oneOf ( :BBQ
                           :Chicken
                           :Mozzarella
                           :TomatoSouce
                         )
             ] ;
     :isInPizza :ChickenBBQPizzaSliced ;
     rdfs:comment "An ingredient"@en ;
     rdfs:label "BBQ"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Celiac
:Celiac rdf:type owl:NamedIndividual ,
                 deseases:K90.0 ,
                 :CeliacDisease ,
                 :Intolerances ;
        rdfs:comment "A disease"@en ;
        rdfs:label "Celiac"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Chicken
```

```
:Chicken rdf:type owl:NamedIndividual ,
                :Chicken ,
                :Ingredients ,
                :Meat ;
        :isInPizza :ChickenBBQPizzaSliced .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/ChickenBBQPizzaSliced
:ChickenBBQPizzaSliced rdf:type owl:NamedIndividual ,
                           :PizzaExpensive ;
                  :chickenBBQPizzaHasIngredients :BBQ ,
                                                 :Chicken ,
                                                 :Mozzarella ,
                                                 :TomatoSouce ;
                  :hasIngredients :BBQ ,
                                  :Chicken ,
                                  :Mozzarella ,
                                  :TomatoSouce ;
                  :hasPanificationProcess :PanificationProcessChickenPizza ;
                  :hasType :Sliced ;
                  :hasPrice 12 ;
                  :isGlutenFree "true"^^xsd:boolean ;
                  :isLactoseFree "false"^^xsd:boolean ;
                  :isPizzaVegetarian "false"^^xsd:boolean ;
                  rdfs:comment "A Sliced pizza with chicken and BBQ"@en ;
                  rdfs:label "ChickenBBQPizzaSliced"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/CookingProcessChickenPizza
:CookingProcessChickenPizza rdf:type owl:NamedIndividual ,
                                :CookingProcess ;
                       rdfs:comment "The cooking process for chicken BBQ pizza"@en ;
                       rdfs:label "CookingProcessChickenPizza"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/CookingProcessPepperoniPiz
za
:CookingProcessPepperoniPizza rdf:type owl:NamedIndividual ,
                                  :CookingProcess ,
                                  :StepClass ;
                         rdfs:comment "Cooking process for Pepperoni pizza"@en ;
                         rdfs:label "CookingProcessPepperoniPizza"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/FermentationChickenPizza
```

```
:FermentationChickenPizza rdf:type owl:NamedIndividual ,
                           :Fermentation ,
                           :StepClass ;
                  rdfs:comment "Fermentation process for chicken pizza"@en ;
                  rdfs:label "FermentationChickenPizza"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/FermentationPepperoniPizza
:FermentationPepperoniPizza rdf:type owl:NamedIndividual ,
                             :Fermentation ,
                             :StepClass ;
                    rdfs:comment "Fermentation process for pepperoni pizza"@en ;
                    rdfs:label "FermentationPepperoniPizza"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Filippo
:Filippo rdf:type owl:NamedIndividual ,
            :User ;
       :hasIntollerance :Celiac ;
       :likesIngredient :Chicken ;
       <https://w3id.org/MON/person.owl#birthDate> "2000-01-01T00:00:00"^^xsd:dateTime ;
       <https://w3id.org/MON/person.owl#firstName> "Filippo" ;
       rdfs:comment "An user, he likes chicken and is celiac"@en ;
       rdfs:label "Filippo"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Francesco
:Francesco rdf:type owl:NamedIndividual ,
              :PizzaMaker ,
              [ rdf:type owl:Restriction ;
                owl:onProperty :works ;
                owl:someValuesFrom :Pizzeria
              ] ;
        :works :PizzeriaDaCiro ;
        <https://w3id.org/MON/person.owl#birthDate> "2000-01-01T00:00:00"^^xsd:dateTime
;
        <https://w3id.org/MON/person.owl#firstName> "Francesco" ;
        rdfs:comment "A PizzaMaker"@en ;
        rdfs:label "Francesco"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Giovanni
:Giovanni rdf:type owl:NamedIndividual ,
              :PizzaMaker ,
              [ rdf:type owl:Restriction ;
                owl:onProperty :works ;
                owl:someValuesFrom :Pizzeria
```

```
            ] ;
        :works :PizzeriaDaCiro ;
        <https://w3id.org/MON/person.owl#birthDate> "2000-01-01T00:00:00"^^xsd:dateTime
;
        <https://w3id.org/MON/person.owl#firstName> "Giovanni" ;
        rdfs:comment "A PizzaMaker"@en ;
        rdfs:label "Giovanni"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Ham
:Ham rdf:type owl:NamedIndividual ,
            :Ingredients ,
            :Meat ,
            :Suine ;
    :isInPizza :HamPizza ;
    rdfs:comment "ham"@en ;
    rdfs:label "Ham"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/HamPizza
:HamPizza rdf:type owl:NamedIndividual ,
                [ rdf:type owl:Restriction ;
                  owl:onProperty :hasIngredients ;
                  owl:someValuesFrom :Ingredients
                ] ;
        :hamPizzaHasIngredients :Ham ,
                            :Mozzarella ,
                            :TomatoSouce ;
        :hasIngredients :Ham ,
                    :Mozzarella ,
                    :TomatoSouce ;
        :isLactoseFree "false"^^xsd:boolean ;
        :isPizzaVegetarian "false"^^xsd:boolean .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/KneadingProcessChickenPizz
a
:KneadingProcessChickenPizza rdf:type owl:NamedIndividual ,
                                :KneadingPhase ,
                                :StepClass ;
                        rdfs:comment "The kneading process for chicken pizza"@en ;
                        rdfs:label "KneadingProcessChickenPizza"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/KneadingProcessPepperoniPi
zza
```

```
:KneadingProcessPepperoniPizza rdf:type owl:NamedIndividual ,
                                :KneadingPhase ,
                                :StepClass ;
                       rdfs:comment "Kneading process for pepperoni pizza"@en ;
                       rdfs:label "KneadingProcessPepperoniPizza"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Lorenzo
:Lorenzo rdf:type owl:NamedIndividual ,
                 :PizzaMaker ,
                 [ rdf:type owl:Restriction ;
                   owl:onProperty :works ;
                   owl:someValuesFrom :Pizzeria
                 ] ;
        :works :PizzeriaDaCiro ;
        <https://w3id.org/MON/person.owl#birthDate> "2000-01-01T00:00:00"^^xsd:dateTime ;
        <https://w3id.org/MON/person.owl#firstName> "Lorenzo" ;
        rdfs:comment "A PizzaMaker"@en ;
        rdfs:label "Lorenzo"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Luca
:Luca rdf:type owl:NamedIndividual ,
              :PizzaMaker ,
              [ rdf:type owl:Restriction ;
                owl:onProperty :works ;
                owl:someValuesFrom :Pizzeria
              ] ;
     :works :MarioPizzas ;
     <https://w3id.org/MON/person.owl#birthDate> "2000-01-01T00:00:00"^^xsd:dateTime ;
     <https://w3id.org/MON/person.owl#firstName> "Luca" ;
     rdfs:comment "A PizzaMaker"@en ;
     rdfs:label "Luca"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/MarioPizzas
:MarioPizzas rdf:type owl:NamedIndividual ,
                   :Pizzeria ,
                   :SmallPizzeria ,
                   [ owl:intersectionOf ( :Pizzeria
                                          [ rdf:type owl:Restriction ;
                                            owl:onProperty :hasEmployee ;
                                            owl:maxQualifiedCardinality "2"^^xsd:nonNegativeInteger ;
                                            owl:onClass :PizzaMaker
                                          ]
                                        ) ;
                     rdf:type owl:Class
                   ] ,
```

```
                [ rdf:type owl:Restriction ;
                  owl:onProperty :hasEmployee ;
                  owl:maxQualifiedCardinality "2"^^xsd:nonNegativeInteger ;
                  owl:onClass :PizzaMaker
                ] ;
          :hasEmployee :Luca ;
          :makes :ChickenBBQPizzaSliced ;
          :hasName "Mario Pizzas" ;
          rdfs:comment "A Pizzeria"@en ;
          rdfs:label "MarioPizzas"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Mozzarella
:Mozzarella rdf:type owl:NamedIndividual ,
                :DairyProducts ,
                :Ingredients ;
          :isInPizza :ChickenBBQPizzaSliced ,
                  :HamPizza ,
                  :PepperoniPizza ,
                  :PepperoniPizzaNapoletana ;
          rdfs:comment "Mozzarella"@en ;
          rdfs:label "Mozzarella"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Napoletana
:Napoletana rdf:type owl:NamedIndividual ,
                :PizzaType ;
          rdfs:comment "A type of Pizza"@en ;
          rdfs:label "Napoletana"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PanificationProcessChickenPi
zza
:PanificationProcessChickenPizza rdf:type owl:NamedIndividual ,
                                  :PanificationProcess ;
                         <http://www.ontologydesignpatterns.org/cp/owl/bag.owl#hasItem>
:Step1PanificationProcessChickenPizza ,

:Step2PanificationProcessChickenPizza ,

:Step3PanificationProcessChickenPizza ,

:Step4PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#hasMember>
:Step1PanificationProcessChickenPizza ,
```

```
:Step2PanificationProcessChickenPizza ,

:Step3PanificationProcessChickenPizza ,

:Step4PanificationProcessChickenPizza ;
                        <http://www.ontologydesignpatterns.org/cp/owl/list.owl#hasFirstItem>
:Step1PanificationProcessChickenPizza ;
                        <http://www.ontologydesignpatterns.org/cp/owl/list.owl#hasLastItem>
:Step4PanificationProcessChickenPizza ;
                        rdfs:comment "The Panification process for chicken pizza"@en ;
                        rdfs:label "PanificationProcessChickenPizza"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PanificationProcessPepperoni
Pizza
:PanificationProcessPepperoniPizza rdf:type owl:NamedIndividual ,
                                    :PanificationProcess ;
                         <http://www.ontologydesignpatterns.org/cp/owl/bag.owl#hasItem>
:Step1PanificationProcessPepperoniPizza ,

:Step2PanificationProcessPepperoniPizza ,

:Step3PanificationProcessPepperoniPizza ,

:Step4PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#hasMember>
:Step1PanificationProcessPepperoniPizza ,

:Step2PanificationProcessPepperoniPizza ,

:Step3PanificationProcessPepperoniPizza ,

:Step4PanificationProcessPepperoniPizza ;
                         <http://www.ontologydesignpatterns.org/cp/owl/list.owl#hasFirstItem>
:Step1PanificationProcessPepperoniPizza ;
                         <http://www.ontologydesignpatterns.org/cp/owl/list.owl#hasLastItem>
:Step4PanificationProcessPepperoniPizza ;
                         rdfs:comment "Panification process for pepperoni pizza"@en ;
                         rdfs:label "PanificationProcessPepperoniPizza"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Pepperoni
:Pepperoni rdf:type owl:NamedIndividual ,
                    :Ingredients ,
                    :Meat ,
```

```
        :Suine ;
    :isInPizza :PepperoniPizza ,
               :PepperoniPizzaNapoletana ;
    rdfs:comment "Pepperoni"@en ;
    rdfs:label "Pepperoni"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PepperoniPizza
:PepperoniPizza rdf:type owl:NamedIndividual ,
                [ rdf:type owl:Restriction ;
                  owl:onProperty :hasIngredients ;
                  owl:someValuesFrom :Ingredients
                ] ;
        :hasIngredients :Mozzarella ,
                        :Pepperoni ,
                        :TomatoSouce ;
        :pepperoniPizzaHasIngredients :Mozzarella ,
                                      :Pepperoni ,
                                      :TomatoSouce ;
        :isLactoseFree "false"^^xsd:boolean ;
        :isPizzaVegetarian "false"^^xsd:boolean .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PepperoniPizzaNapoletana
:PepperoniPizzaNapoletana rdf:type owl:NamedIndividual ,
                          :PizzaCheap ,
                          [ rdf:type owl:Restriction ;
                            owl:onProperty :hasIngredients ;
                            owl:someValuesFrom :Ingredients
                          ] ;
                  :hasIngredients :Mozzarella ,
                                  :Pepperoni ,
                                  :TomatoSouce ;
                  :hasPanificationProcess :PanificationProcessPepperoniPizza ;
                  :hasType :Napoletana ;
                  :pepperoniPizzaHasIngredients :Mozzarella ,
                                                :Pepperoni ,
                                                :TomatoSouce ;
                  :hasPrice 10 ;
                  :isGlutenFree "false"^^xsd:boolean ;
                  :isLactoseFree "false"^^xsd:boolean ;
                  :isPizzaVegetarian "false"^^xsd:boolean ;
                  rdfs:comment "A Napoletana Pepperoni Pizza"@en ;
                  rdfs:label "PepperoniPizzaNapoletana"@en .


### http://www.semanticweb.org/federico/ontologies/2024/1/pizza/PizzeriaDaCiro
```

```
:PizzeriaDaCiro rdf:type owl:NamedIndividual ,
                    :Pizzeria ;
             :hasEmployee :Francesco ,
                          :Giovanni ,
                          :Lorenzo ;
             :makes :PepperoniPizzaNapoletana ;
             :hasName "Pizzeria Da Ciro" ;
             rdfs:comment "A Pizzeria"@en ;
             rdfs:label "PizzeriaDaCiro"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/ShapingChickenPizza
:ShapingChickenPizza rdf:type owl:NamedIndividual ,
                           :Shaping ,
                           :StepClass ;
                  rdfs:comment "Shaping Process for chicken bbq pizza"@en ;
                  rdfs:label "ShapingChickenPizza"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/ShapingPepperoniPizza
:ShapingPepperoniPizza rdf:type owl:NamedIndividual ,
                             :Shaping ,
                             :StepClass ;
                    rdfs:comment "Shaping process for Pepperoni pizza"@en ;
                    rdfs:label "ShapingPepperoniPizza"@en .


###  http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Sliced
:Sliced rdf:type owl:NamedIndividual ,
               :PizzaType ;
        rdfs:comment "A pizza type"@en ;
        rdfs:label "Sliced"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step1PanificationProcessChic
kenPizza
:Step1PanificationProcessChickenPizza rdf:type owl:NamedIndividual ,
                                            :Step ;

<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemContent>
:KneadingProcessChickenPizza ;
                               <http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemOf>
:PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#isMemberOf>
:PanificationProcessChickenPizza ;
```

<http://www.ontologydesignpatterns.org/cp/owl/list.owl#firstItemOf>
:PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyPrecedes>
:Step2PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#precedes>
:Step2PanificationProcessChickenPizza ,

:Step3PanificationProcessChickenPizza ,

:Step4PanificationProcessChickenPizza ;
rdfs:comment "1 step of the panification process for chicken
pizza"@en ;
rdfs:label "Step1PanificationProcessChickenPizza"@en .

###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step1PanificationProcessPep
peroniPizza
:Step1PanificationProcessPepperoniPizza rdf:type owl:NamedIndividual ,
:Step ;

<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemContent>
:KneadingProcessPepperoniPizza ;
<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemOf>
:PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#isMemberOf>
:PanificationProcessPepperoniPizza ;
<http://www.ontologydesignpatterns.org/cp/owl/list.owl#firstItemOf>
:PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyPrecedes>
:Step2PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#precedes>
:Step2PanificationProcessPepperoniPizza ,

:Step3PanificationProcessPepperoniPizza ,

:Step4PanificationProcessPepperoniPizza ;
rdfs:comment "1 step of the panification process for pepperoni
pizza"@en ;
rdfs:label "Step1PanificationProcessPepperoniPizza"@en .

```
###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step2PanificationProcessChic
kenPizza
:Step2PanificationProcessChickenPizza rdf:type owl:NamedIndividual ,
                                      :Step ;

<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemContent>
:ShapingChickenPizza ;
                              <http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemOf>
:PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#isMemberOf>
:PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyFollows>
:Step1PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyPrecedes>
:Step3PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#follows>
:Step1PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#precedes>
:Step3PanificationProcessChickenPizza ,

:Step4PanificationProcessChickenPizza ;
                              rdfs:comment "2 step of the panification process for chicken
pizza"@en ;
                              rdfs:label "Step2PanificationProcessChickenPizza"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step2PanificationProcessPep
peroniPizza
:Step2PanificationProcessPepperoniPizza rdf:type owl:NamedIndividual ,
                                        :Step ;

<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemContent>
:ShapingPepperoniPizza ;
                                <http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemOf>
:PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#isMemberOf>
:PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyFollows>
:Step1PanificationProcessPepperoniPizza ;
```

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyPrecedes>
:Step3PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#follows>
:Step1PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#precedes>
:Step3PanificationProcessPepperoniPizza ,

:Step4PanificationProcessPepperoniPizza ;
rdfs:comment "2 step of the panification process for pepperoni pizza"@en ;
rdfs:label "Step2PanificationProcessPepperoniPizza"@en .

###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step3PanificationProcessChickenPizza
:Step3PanificationProcessChickenPizza rdf:type owl:NamedIndividual ,
:Step ;

<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemContent>
:FermentationChickenPizza ;
<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemOf>
:PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#isMemberOf>
:PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyFollows>
:Step2PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyPrecedes>
:Step4PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#follows>
:Step1PanificationProcessChickenPizza ,

:Step2PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#precedes>
:Step4PanificationProcessChickenPizza ;
rdfs:comment "3 step of the panification process for chicken pizza"@en ;
rdfs:label "Step3PanificationProcessChickenPizza"@en .

```
###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step3PanificationProcessPepperoniPizza
:Step3PanificationProcessPepperoniPizza rdf:type owl:NamedIndividual ,
                                        :Step ;

<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemContent>
:FermentationPepperoniPizza ;
                                <http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemOf>
:PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#isMemberOf>
:PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyFollows>
:Step2PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyPrecedes>
:Step4PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#follows>
:Step1PanificationProcessPepperoniPizza ,

:Step2PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#precedes>
:Step4PanificationProcessPepperoniPizza ;
                                rdfs:comment "3 step of the panification process for pepperoni
pizza"@en ;
                                rdfs:label "Step3PanificationProcessPepperoniPizza"@en .


###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step4PanificationProcessChickenPizza
:Step4PanificationProcessChickenPizza rdf:type owl:NamedIndividual ,
                                      :Step ;

<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemContent>
:CookingProcessChickenPizza ;
                               <http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemOf>
:PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#isMemberOf>
:PanificationProcessChickenPizza ;
                               <http://www.ontologydesignpatterns.org/cp/owl/list.owl#lastItemOf>
:PanificationProcessChickenPizza ;
```

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyFollows>
:Step3PanificationProcessChickenPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#follows>
:Step1PanificationProcessChickenPizza ,

:Step2PanificationProcessChickenPizza ,

:Step3PanificationProcessChickenPizza ;
rdfs:comment "4 step of the panification process for chicken pizza"@en ;
rdfs:label "Step4PanificationProcessChickenPizza"@en .

###
http://www.semanticweb.org/federico/ontologies/2024/1/pizza/Step4PanificationProcessPepperoniPizza
:Step4PanificationProcessPepperoniPizza rdf:type owl:NamedIndividual ,
:Step ;

<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemContent>
:CookingProcessPepperoniPizza ;
<http://www.ontologydesignpatterns.org/cp/owl/bag.owl#itemOf>
:PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#isMemberOf>
:PanificationProcessPepperoniPizza ;
<http://www.ontologydesignpatterns.org/cp/owl/list.owl#lastItemOf>
:PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#directlyFollows>
:Step3PanificationProcessPepperoniPizza ;

<http://www.ontologydesignpatterns.org/cp/owl/sequence.owl#follows>
:Step1PanificationProcessPepperoniPizza ,

:Step2PanificationProcessPepperoniPizza ,

:Step3PanificationProcessPepperoniPizza ;
rdfs:comment "4 step of the panification process for pepperoni pizza"@en ;
rdfs:label "Step4PanificationProcessPepperoniPizza"@en .

http://www.semanticweb.org/federico/ontologies/2024/1/pizza/TomatoSouce
:TomatoSouce rdf:type owl:NamedIndividual ,
:Ingredients ,

```
                :Vegetables ;
            :isInPizza :ChickenBBQPizzaSliced ,
                :HamPizza ,
                :PepperoniPizza ,
                :PepperoniPizzaNapoletana ;
            rdfs:comment "TomatoSouce"@en ;
            rdfs:label "TomatoSouce"@en .


#################################################################
#    Annotations
#################################################################

:Chicken rdfs:comment "Chicken"@en ;
        rdfs:label "Chicken"@en .


:HamPizza rdfs:comment "A Pizza with ham, Tomato Souce, Mozzarella"@en ;
         rdfs:label "HamPizza"@en .


:PepperoniPizza rdfs:comment "A Pizza with pepperoni, Tomato Souce, Mozzarella"@en ;
              rdfs:label "PepperoniPizza"@en .


#################################################################
#    General axioms
#################################################################

[ rdf:type owl:Restriction ;
  owl:onProperty :hamPizzaHasIngredients ;
  owl:qualifiedCardinality "3"^^xsd:nonNegativeInteger ;
  owl:onClass :Ingredients ;
  rdfs:subClassOf [ rdf:type owl:Restriction ;
                    owl:onProperty :hasIngredients ;
                    owl:someValuesFrom :Ingredients
                  ]
] .


[ rdf:type owl:Restriction ;
  owl:onProperty :pepperoniPizzaHasIngredients ;
  owl:qualifiedCardinality "3"^^xsd:nonNegativeInteger ;
  owl:onClass :Ingredients ;
  rdfs:subClassOf [ rdf:type owl:Restriction ;
                    owl:onProperty :hasIngredients ;
                    owl:someValuesFrom :Ingredients
                  ]
```

```
] .


[ rdf:type owl:AllDisjointClasses ;
  owl:members ( :ChickenBBQPizza
                :HamPizza
                :PepperoniPizza
              )
] .


[ rdf:type owl:AllDisjointClasses ;
  owl:members ( :DairyProducts
                :Meat
                :Vegetables
              )
] .


[ rdf:type owl:AllDifferent ;
  owl:distinctMembers ( :BBQ
                        :Chicken
                        :Ham
                        :Mozzarella
                        :Pepperoni
                        :TomatoSouce
                      )
] .


[ rdf:type owl:AllDifferent ;
  owl:distinctMembers ( :Francesco
                        :Giovanni
                        :Lorenzo
                        :Luca
                      )
] .


[ rdf:type owl:AllDifferent ;
  owl:distinctMembers ( :Step1PanificationProcessChickenPizza
                        :Step2PanificationProcessChickenPizza
                        :Step3PanificationProcessChickenPizza
                        :Step4PanificationProcessChickenPizza
                      )
] .
```

```
[ rdf:type owl:AllDifferent ;
  owl:distinctMembers ( :Step1PanificationProcessPepperoniPizza
                        :Step2PanificationProcessPepperoniPizza
                        :Step3PanificationProcessPepperoniPizza
                        :Step4PanificationProcessPepperoniPizza
                      )
] .


#################################################################
#    Rules
#################################################################

:x rdf:type <http://www.w3.org/2003/11/swrl#Variable> .

:y rdf:type <http://www.w3.org/2003/11/swrl#Variable> .

:n rdf:type <http://www.w3.org/2003/11/swrl#Variable> .

[ <http://swrl.stanford.edu/ontologies/3.3/swrla.owl#isRuleEnabled> "true"^^xsd:boolean ;
   rdfs:comment "Set the flag isPizzaVegetarian is there is no meat in the ingredients" ;
   rdfs:label "Pizza_Vegetarian" ;
   rdf:type <http://www.w3.org/2003/11/swrl#Imp> ;
   <http://www.w3.org/2003/11/swrl#body> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                rdf:first [ rdf:type <http://www.w3.org/2003/11/swrl#ClassAtom> ;
                                        <http://www.w3.org/2003/11/swrl#classPredicate> :Pizza ;
                                        <http://www.w3.org/2003/11/swrl#argument1> :x
                                      ] ;
                                rdf:rest [ rdf:type <http://www.w3.org/2003/11/swrl#AtomList> ;
                                        rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#IndividualPropertyAtom> ;

<http://www.w3.org/2003/11/swrl#propertyPredicate> :hasIngredients ;
                                                <http://www.w3.org/2003/11/swrl#argument1> :x ;
                                                <http://www.w3.org/2003/11/swrl#argument2> :y
                                              ] ;
                                        rdf:rest [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                                rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#ClassAtom> ;

<http://www.w3.org/2003/11/swrl#classPredicate> :Meat ;

<http://www.w3.org/2003/11/swrl#argument1> :y
                                                        ] ;
                                                rdf:rest rdf:nil
                                              ]
```

```
                                    ]
                                ] ;
  <http://www.w3.org/2003/11/swrl#head> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                  rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#DatavaluedPropertyAtom> ;
                                    <http://www.w3.org/2003/11/swrl#propertyPredicate>
:isPizzaVegetarian ;
                                    <http://www.w3.org/2003/11/swrl#argument1> :x ;
                                    <http://www.w3.org/2003/11/swrl#argument2>
"false"^^xsd:boolean
                                  ] ;
                                  rdf:rest rdf:nil
                                ]
] .

[ <http://swrl.stanford.edu/ontologies/3.3/swrla.owl#isRuleEnabled> "true"^^xsd:boolean ;
  rdfs:comment "A rule to insert pizzas that cost more than 11 into the expensivePizza class"
;
  rdfs:label "Pizza_Expensive" ;
  rdf:type <http://www.w3.org/2003/11/swrl#Imp> ;
  <http://www.w3.org/2003/11/swrl#body> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                  rdf:first [ rdf:type <http://www.w3.org/2003/11/swrl#ClassAtom> ;
                                    <http://www.w3.org/2003/11/swrl#classPredicate> :Pizza ;
                                    <http://www.w3.org/2003/11/swrl#argument1> :x
                                  ] ;
                                  rdf:rest [ rdf:type <http://www.w3.org/2003/11/swrl#AtomList> ;
                                    rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#DatavaluedPropertyAtom> ;

<http://www.w3.org/2003/11/swrl#propertyPredicate> :hasPrice ;
                                      <http://www.w3.org/2003/11/swrl#argument1> :x ;
                                      <http://www.w3.org/2003/11/swrl#argument2> :n
                                    ] ;
                                  rdf:rest [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                    rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#BuiltinAtom> ;
                                      <http://www.w3.org/2003/11/swrl#builtin>
<http://www.w3.org/2003/11/swrlb#greaterThan> ;

<http://www.w3.org/2003/11/swrl#arguments> [ rdf:type rdf:List ;
                                                    rdf:first :n ;
                                                    rdf:rest [
rdf:type rdf:List ;
                                                      rdf:first
11 ;
```

```
                                                                    rdf:rest
rdf:nil
                                                                        ]
                                                                    ]
                                                                ] ;
                                                            rdf:rest rdf:nil
                                                        ]
                                                    ]
                                                ] ;
  <http://www.w3.org/2003/11/swrl#head> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                    rdf:first [ rdf:type <http://www.w3.org/2003/11/swrl#ClassAtom> ;
                                            <http://www.w3.org/2003/11/swrl#classPredicate>
:PizzaExpensive ;
                                            <http://www.w3.org/2003/11/swrl#argument1> :x
                                        ] ;
                                    rdf:rest rdf:nil
                                ]
] .

[ <http://swrl.stanford.edu/ontologies/3.3/swrla.owl#isRuleEnabled> "true"^^xsd:boolean ;
  rdfs:comment "A pizza is Cheap if it costs max 11" ;
  rdfs:label "Pizza_Cheap" ;
  rdf:type <http://www.w3.org/2003/11/swrl#Imp> ;
  <http://www.w3.org/2003/11/swrl#body> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                    rdf:first [ rdf:type <http://www.w3.org/2003/11/swrl#ClassAtom> ;
                                            <http://www.w3.org/2003/11/swrl#classPredicate> :Pizza ;
                                            <http://www.w3.org/2003/11/swrl#argument1> :x
                                        ] ;
                                    rdf:rest [ rdf:type <http://www.w3.org/2003/11/swrl#AtomList> ;
                                            rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#DatavaluedPropertyAtom> ;

<http://www.w3.org/2003/11/swrl#propertyPredicate> :hasPrice ;
                                                <http://www.w3.org/2003/11/swrl#argument1> :x ;
                                                <http://www.w3.org/2003/11/swrl#argument2> :n
                                            ] ;
                                        rdf:rest [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                                rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#BuiltinAtom> ;
                                                        <http://www.w3.org/2003/11/swrl#builtin>
<http://www.w3.org/2003/11/swrlb#lessThanOrEqual> ;

<http://www.w3.org/2003/11/swrl#arguments> [ rdf:type rdf:List ;
                                                                    rdf:first :n ;
```

```
                                                                                rdf:rest [
rdf:type rdf:List ;
                                                                                    rdf:first
11 ;
                                                                                    rdf:rest
rdf:nil
                                                                                ]
                                                                            ]
                                                    ] ;
                                                rdf:rest rdf:nil
                                            ]
                                        ]
                                ] ;
  <http://www.w3.org/2003/11/swrl#head> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                    rdf:first [ rdf:type <http://www.w3.org/2003/11/swrl#ClassAtom> ;
                                            <http://www.w3.org/2003/11/swrl#classPredicate>
:PizzaCheap ;
                                            <http://www.w3.org/2003/11/swrl#argument1> :x
                                        ] ;
                                    rdf:rest rdf:nil
                                ]
] .

[ <http://swrl.stanford.edu/ontologies/3.3/swrla.owl#isRuleEnabled> "true"^^xsd:boolean ;
  rdfs:comment "If a person works in a Pizzeria it's a PizzaMaker" ;
  rdfs:label "Person_PizzaMaker" ;
  rdf:type <http://www.w3.org/2003/11/swrl#Imp> ;
  <http://www.w3.org/2003/11/swrl#body> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                    rdf:first [ rdf:type <http://www.w3.org/2003/11/swrl#ClassAtom> ;
                                            <http://www.w3.org/2003/11/swrl#classPredicate>
<https://w3id.org/MON/person.owl#Person> ;
                                            <http://www.w3.org/2003/11/swrl#argument1> :x
                                        ] ;
                                    rdf:rest [ rdf:type <http://www.w3.org/2003/11/swrl#AtomList> ;
                                            rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#IndividualPropertyAtom> ;

<http://www.w3.org/2003/11/swrl#propertyPredicate> :works ;
                                                <http://www.w3.org/2003/11/swrl#argument1> :x ;
                                                <http://www.w3.org/2003/11/swrl#argument2> :y
                                            ] ;
                                        rdf:rest [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                                rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#ClassAtom> ;
```

```
<http://www.w3.org/2003/11/swrl#classPredicate> :Pizzeria ;

<http://www.w3.org/2003/11/swrl#argument1> :y
                                                ] ;
                                          rdf:rest rdf:nil
                                        ]
                                    ]
                               ] ;
  <http://www.w3.org/2003/11/swrl#head> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                rdf:first [ rdf:type <http://www.w3.org/2003/11/swrl#ClassAtom> ;
                                        <http://www.w3.org/2003/11/swrl#classPredicate>
:PizzaMaker ;
                                        <http://www.w3.org/2003/11/swrl#argument1> :x
                                      ] ;
                                rdf:rest rdf:nil
                               ]
 ] .

[ <http://swrl.stanford.edu/ontologies/3.3/swrla.owl#isRuleEnabled> "true"^^xsd:boolean ;
  rdfs:comment "A rule to set isLactoseFree flag to false if there are dairy products in the
ingredients" ;
  rdfs:label "LactoseFree" ;
  rdf:type <http://www.w3.org/2003/11/swrl#Imp> ;
  <http://www.w3.org/2003/11/swrl#body> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                rdf:first [ rdf:type <http://www.w3.org/2003/11/swrl#ClassAtom> ;
                                        <http://www.w3.org/2003/11/swrl#classPredicate> :Pizza ;
                                        <http://www.w3.org/2003/11/swrl#argument1> :x
                                      ] ;
                                rdf:rest [ rdf:type <http://www.w3.org/2003/11/swrl#AtomList> ;
                                        rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#IndividualPropertyAtom> ;

<http://www.w3.org/2003/11/swrl#propertyPredicate> :hasIngredients ;
                                                <http://www.w3.org/2003/11/swrl#argument1> :x ;
                                                <http://www.w3.org/2003/11/swrl#argument2> :y
                                              ] ;
                                        rdf:rest [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                                                rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#ClassAtom> ;

<http://www.w3.org/2003/11/swrl#classPredicate> :DairyProducts ;

<http://www.w3.org/2003/11/swrl#argument1> :y
                                                ] ;
```

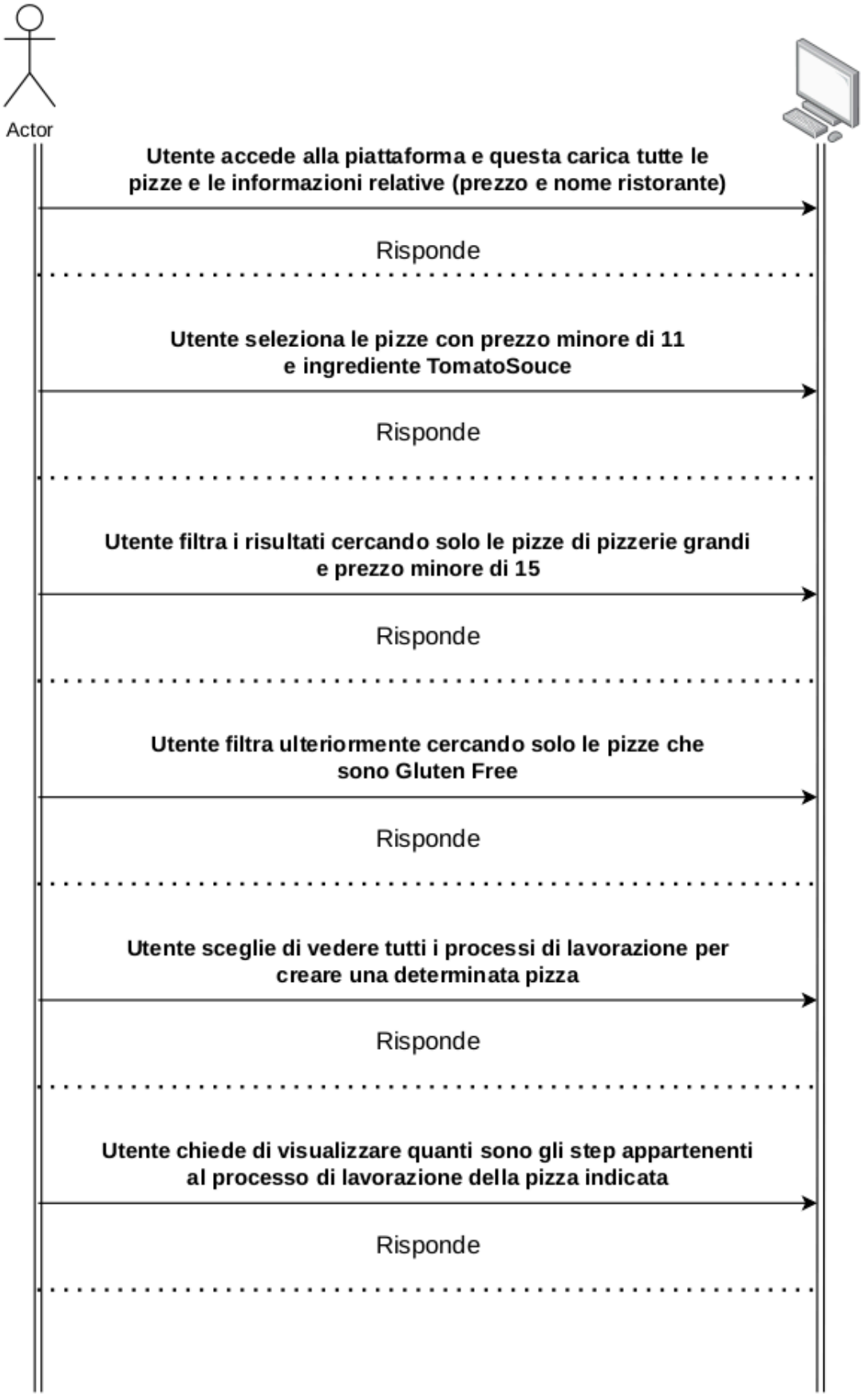
```
                                        rdf:rest rdf:nil
                                      ]
                                ]
                            ] ;
  <http://www.w3.org/2003/11/swrl#head> [ rdf:type
<http://www.w3.org/2003/11/swrl#AtomList> ;
                              rdf:first [ rdf:type
<http://www.w3.org/2003/11/swrl#DatavaluedPropertyAtom> ;
                                  <http://www.w3.org/2003/11/swrl#propertyPredicate>
:isLactoseFree ;
                                  <http://www.w3.org/2003/11/swrl#argument1> :x ;
                                  <http://www.w3.org/2003/11/swrl#argument2>
"false"^^xsd:boolean
                                ] ;
                              rdf:rest rdf:nil
                            ]
 ] .

###  Generated by the OWL API (version 4.5.25.2023-02-15T19:15:49Z)
https://github.com/owlcs/owlapi
```

Query SPARQL

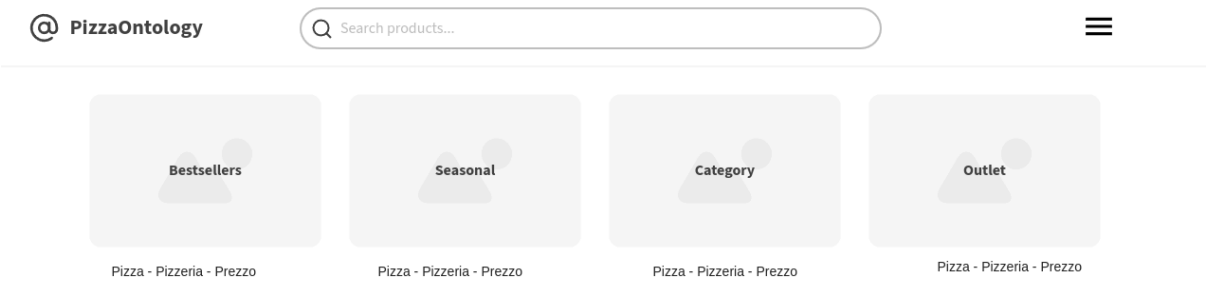
Flow Chart di interazione

Per lo sviluppo del Flow Chart ho pensato a quali potessero essere le principali azioni che un utente potrebbe effettuare una volta interfacciato a PizzaOntology.

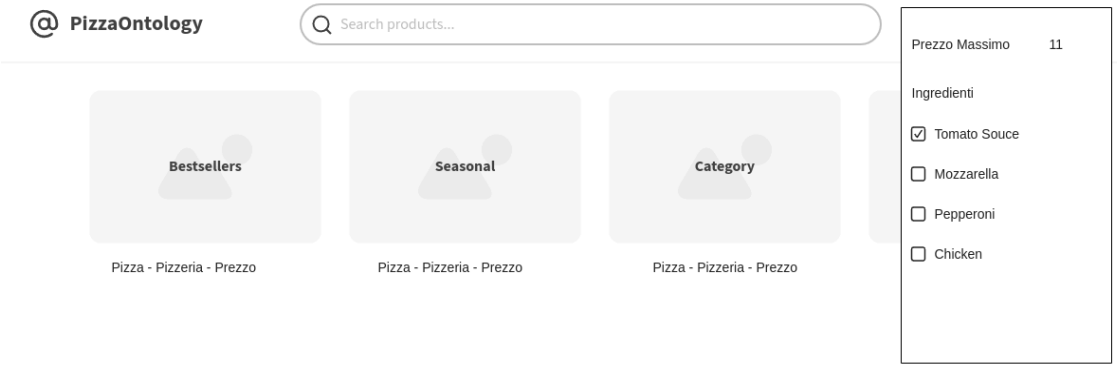

Actor
Utente accede alla piattaforma e questa carica tutte le pizze e le informazioni relative (prezzo e nome ristorante)
Risponde
Utente seleziona le pizze con prezzo minore di 11 e ingrediente TomatoSouce
Risponde
Utente filtra i risultati cercando solo le pizze di pizzerie grandi e prezzo minore di 15
Risponde
Utente filtra ulteriormente cercando solo le pizze che sono Gluten Free
Risponde
Utente sceglie di vedere tutti i processi di lavorazione per creare una determinata pizza
Risponde
Utente chiede di visualizzare quanti sono gli step appartenenti al processo di lavorazione della pizza indicata
Risponde

Schema di interfaccia

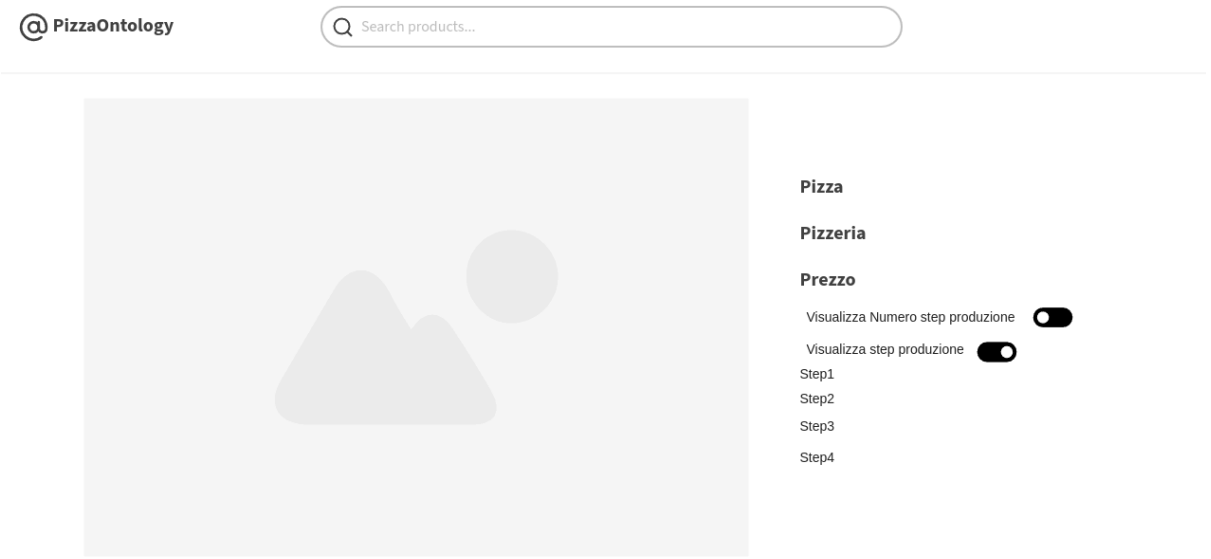
Ho creato i seguenti mock per avere un'idea di quella che potrebbe essere la piattaforma per consultare l'ontologia.



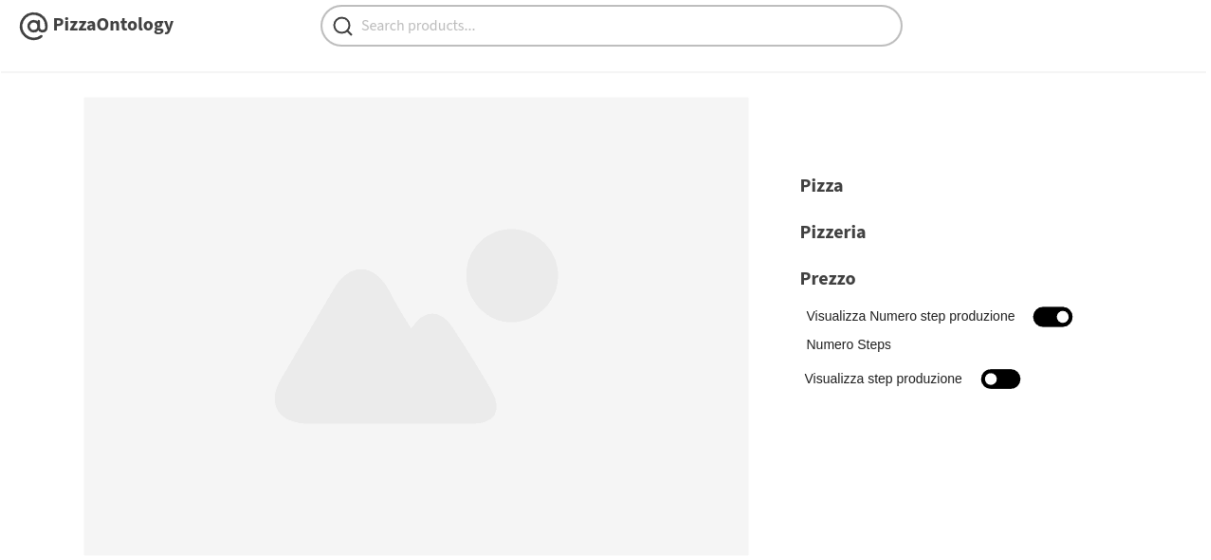
Questo primo mock rappresenta la home, ovvero la prima schermata che vede l'utente appena apre la piattaforma, in questa sono caricate tutte le pizze e le loro informazioni più importanti (Pizzeria, costo).



In questo mock invece ho voluto inserire quello che potrebbe essere l'inserimento dei filtri per la ricerca, in questo caso, vengono ricercate tutte le pizze con ingrediente Tomato Souce e prezzo massimo 11.



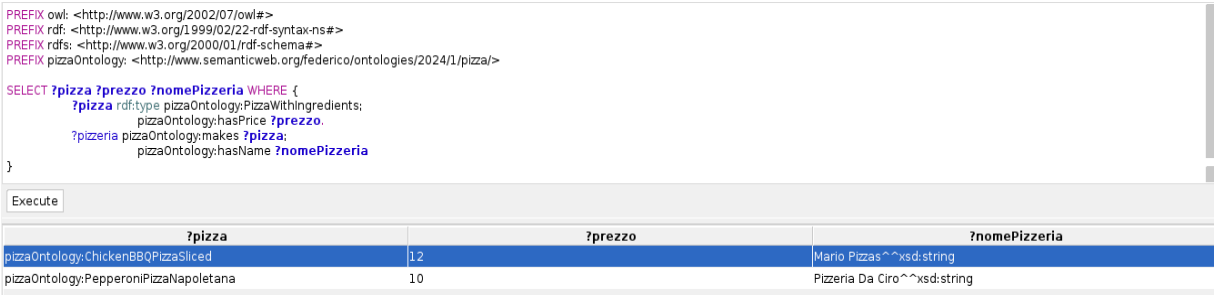
Questo è il mock che raffigura una singola pizza, si possono trovare le informazioni principali citate prima e c'è la possibilità di vedere sia gli step di produzione, sia di visualizzare solo il numero di step necessari per la preparazione della pizza, in questo caso vengono visualizzati solamente gli step per intero e non il numero.



Questo mock è il reciproco di quello di prima in cui gli step singoli non sono visualizzati ma è visualizzato solamente il numero totale di step.

Utente accede alla piattaforma e questa carica tutte le pizze e le informazioni relative (prezzo e nome ristorante)

Per ottenere i dati riguardanti queste informazioni ho effettuato una query su tutte le pizze, andando anche a selezionare le pizzerie che hanno una relazione con le pizze trovate e il prezzo di ciascuna di queste.



```
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX pizzaOntology: <http://www.semanticweb.org/federico/ontologies/2024/1/pizza/>

SELECT ?pizza ?prezzo ?nomePizzeria WHERE {
        ?pizza rdf:type pizzaOntology:PizzaWithIngredients;
                pizzaOntology:hasPrice ?prezzo.
        ?pizzeria pizzaOntology:makes ?pizza;
                pizzaOntology:hasName ?nomePizzeria
}
```

Execute

?pizza	?prezzo	?nomePizzeria
pizzaOntology:ChickenBBQPizzaSliced	12	Mario Pizzas^^xsd:string
pizzaOntology:PepperoniPizzaNapoletana	10	Pizzeria Da Ciro^^xsd:string

Vediamo quindi nella parte inferiore dell'immagine, nell'area in cui vengono restituiti i risultati della query, le due pizze presenti nell'A-Box, il loro prezzo e il nome della pizzeria che fa la pizza.

Utente seleziona le pizze con prezzo minore di 11 e ingrediente TomatoSouce

Per ottenere i risultati riguardanti queste informazioni ho modificato la query precedente andando ad inserire un filtre sul parametro del prezzo per andare a individuare solamente le pizze che hanno un prezzo minore di 11, ovvero il dato inserito dall'utente.

```
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX pizzaOntology: <http://www.semanticweb.org/federico/ontologies/2024/1/pizza/>

SELECT ?pizza ?prezzo ?nomePizzeria WHERE {
        ?pizza pizzaOntology:hasIngredients pizzaOntology:TomatoSouce;
                pizzaOntology:hasPrice ?prezzo.
        ?pizzeria pizzaOntology:makes ?pizza;
                pizzaOntology:hasName ?nomePizzeria
        FILTER (?prezzo < 11)
```

Execute

?pizza	?prezzo	?nomePizzeria
pizzaOntology:PepperoniPizzaNapoletana	10	Pizzeria Da Ciro^^xsd:string

Vediamo restituita una sola pizza, con le sue caratteristiche citate nella query precedente (prezzo e nome della pizzeria).

Utente sceglie solo le pizzerie grandi e prezzo minore di 15

Per ottenere i risultati di questa query ho modificato la query precedente, andando a inserire una nuova soglia massima di prezzo, e inoltre, ho inserito una nuova clausola legata alla pizzeria, ovvero di essere una pizzeria grande, ovvero una pizzeria con più di 3 pizzaioli.

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX pizzaOntology: <http://www.semanticweb.org/federico/ontologies/2024/1/pizza/>

SELECT ?pizza ?prezzo ?nomePizzeria WHERE {
        ?pizza pizzaOntology:hasIngredients pizzaOntology:TomatoSouce;
                pizzaOntology:hasPrice ?prezzo.
        ?pizzeria pizzaOntology:makes ?pizza;
                pizzaOntology:hasName ?nomePizzeria;
                rdf:type pizzaOntology:BigPizzeria
        FILTER (?prezzo < 15)

}
```

Execute

?pizza	?prezzo	?nomePizzeria
pizzaOntology:PepperoniPizzaNapoletana	10	Pizzeria Da Ciro^^xsd:string

Anche in questo caso vediamo restituita una sola pizza, con le sue caratteristiche citate nelle query precedente (prezzo e nome della pizzeria).

Utente filtra ulteriormente cercando solo le pizze che sono Gluten Free

Per ottenere i risultati di questa query ho modificato la query precedente, andando a inserire una nuova clausola legata alla pizza, ovvero di essere gluten free, per farlo ho utilizzato la data propriety associata alla pizza isGlutenFree che è di tipo boolean.
Inoltre a differenza della query precedente sono andato a rimuovere il filtro che era stato inserito precedentemente per quanto riguarda la selezione di pizze create solamente da pizzerie grandi.

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX pizzaOntology: <http://www.semanticweb.org/federico/ontologies/2024/1/pizza/>

SELECT ?pizza ?prezzo ?nomePizzeria WHERE {
        ?pizza pizzaOntology:hasIngredients pizzaOntology:TomatoSouce;
                pizzaOntology:hasPrice ?prezzo;
                pizzaOntology:isGlutenFree True.
        ?pizzeria pizzaOntology:makes ?pizza;
                pizzaOntology:hasName ?nomePizzeria
        FILTER (?prezzo < 15)

}
```

Execute

?pizza	?prezzo	?nomePizzeria
pizzaOntology:ChickenBBQPizzaSliced	12	Mario Pizzas^^xsd:string

Utente sceglie di vedere tutti i processi di lavorazione dietro una pizza

Per ottenere i risultati riguardanti questa query ho simulato la selezione di una pizza da parte dell'utente, per poi andare a prendere il panificationProcess relativo a quella specifica pizza. Una volta ottenuto il panificationProcess sono andato a prendere gli step che lo compongono e li ho restituiti come risposta.

```
PREFIX collection: <http://www.ontologydesignpatterns.org/cp/owl/collectionentity.owl#>
PREFIX bag: <http://www.ontologydesignpatterns.org/cp/owl/bag.owl#>
PREFIX pizzaOntology: <http://www.semanticweb.org/federico/ontologies/2024/1/pizza/>

SELECT ?step WHERE {
        ?pizza rdf:type pizzaOntology:ChickenBBQPizza;
                pizzaOntology:hasPanificationProcess ?panificationProcess.
        ?panificationProcess bag:hasItem ?item.
        ?item bag:itemContent ?step
}
GROUP BY ?step
```

Execute

?step
pizzaOntology:FermentationChickenPizza
pizzaOntology:CookingProcessChickenPizza
pizzaOntology:KneadingProcessChickenPizza
pizzaOntology:ShapingChickenPizza

Utente chiede quanti sono gli step per la creazione della pizza desiderata

Per ottenere i risultati riguardanti questa query ho modificato la query precedente facendo un passo indietro nella selezione degli step, infatti in questo caso non sono più interessato di sapere i singoli step ma voglio solamente contare quanti sono gli item interni al panificationProcess.
Per riuscire a restituire in output il numero di items quindi ho utilizzato la funzione COUNT e la funzione AS per dare un nome al risultato del COUNT.

SWRL

In questa sezione riporto le regole SWRL che ho inserito per valorizzare delle proprietà sugli individui oppure per dare una classe più specifica.

Le regole che ho pensato di inserire sono le seguenti:

- Se pizza contiene almeno un ingrediente facente parte della classe dairy products, allora la pizza avrà il flag isLactosefree = false
    - Pizza(?x) ^ hasIngredients(?x, ?y) ^ DairyProducts(?y) -> isLactoseFree(?x, False)
- Se la pizza ha un prezzo maggiore di 11 allora la pizza verrà inserita nella classe pizzaExpensive
    - Pizza(?x) ^ hasPrice(?x, ?n) ^ swrlb:greaterThan(?n, 11) -> PizzaExpensive(?x)
- Se la pizza ha un prezzo minore o uguale di 11 allora la pizza verrà inserita nella classe pizzaCheap
    - Pizza(?x) ^ hasPrice(?x, ?n) ^ swrlb:lessThanOrEqual(?n, 11) -> PizzaCheap(?x)
- Se la pizza ha negli ingredienti almeno un elemento che appartiene alla classe Meat, allora il flag isPizzaVegetarian viene settato a False
    - Pizza(?x) ^ hasIngredients(?x, ?y) ^ Meat(?y) -> isPizzaVegetarian(?x, False)
- Se una persona lavora in una pizzeria allora è un pizzaMaker
    - Person(?x) ^ works(?x ?y) ^Pizzeria(?y) -> PizzaMaker(?x)

Esercizio di modellazione

Ho inserito i seguenti punti nella mia ontologia nelle classi riportate tra parentesi

• almeno 10 classi e 4 proprietà e almeno 2 data properties (su tipi di dato diversi)
• una tassonomia di almeno 3 livelli (4 per gruppi di due); -> (Ingredients)
• uso di relazioni inverse, transitive e funzionali; -> (Inversa: works - hasEmployee.
Transitiva: follow, Funzionale: works)
• almeno 2 classi definite con restrizioni some e min (BigPizzeria, PizzaWithIngredints)
• una classe enumerata; (ingredienti della pizza)
• utilizzo di pattern (per esempio: insiemi, liste, evento, ecc.); (lista->processo panificazione)
• utilizzo di una property chain; -> Pizzeria fa pizzaType
• A-Box con 2 esempi completi; 2/2
• Allineamento con almeno 2 ontologie standard, via SKOS, rdfs:subclass oppure
owl:equivalentClass (motivare la scelta del tipo di relazione scelta). (Person, intolerances)