Ontologies and the Semantic Web – CSE488

Submitted by:

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Problem Description

Overview

Creating a Semantic Web project involves designing an ontology, populating it with data, querying the ontology, manipulating it using tools like Jena, and finally building a Java application to interact with the ontology. In this project, we focus on modeling a movie ontology, populating it with relevant data, querying it using SPARQL, manipulating it using Jena, and building a Java application for movie search based on various criteria such as actors, directors, and genres.

Objectives

The primary objectives of this project are as follows:

1. Modeling the Ontology: Define classes, properties, and relationships to represent movies, persons (actors, directors, writers), genres, and other relevant concepts using Protégé.
2. Populating the Ontology: Populate the ontology with sample data for movies and persons.
3. Querying the Ontology: Write SPARQL queries to retrieve specific information from the ontology such as listing actors, directors, writers, movies by genre, etc.
4. Manipulating the Ontology: Use Jena to manipulate the ontology, perform inference, and execute queries programmatically.
5. Java Application Development: Develop a Java application that interacts with the ontology, allowing users to search for movies based on various criteria.

Ontology Analysis

1. Entities

This ontology defines several key classes and individuals within the domain of movies. Here's a breakdown:

Classes

Person: Represents people involved in movies, with subclasses for specific roles like Actor, Director, and Writer.

Movie: Represents movies, containing information like title, year, genre, and people involved.

Genre: Represents movie genres like Action, Comedy, Crime, etc.

Individuals

People: Includes specific individuals like Edgar Wright, Quentin Tarantino, Uma Thurman, etc., each categorized under their respective roles (Actor, Director, Writer).

Movies: Includes specific movie titles like Pulp Fiction, Shaun of the Dead, The Shawshank Redemption, etc., each with its attributes.

Genres: Lists individual genres like Action, Comedy, Thriller, etc.

Relationships between entities:

Movies are connected to People through properties like hasActor, hasDirector, hasWriter. This indicates the people involved in each movie.

People are connected to Movies through inverse properties like isActorOf, isDirectorOf, isWriterOf. This allows for navigating from a person to the movies they participated in.

Movies are associated with Genres using the hasGenre property, specifying the genre(s) of a movie.

2. Relations (Properties)

This ontology utilizes both object properties and data properties to establish relationships between entities:

Object Properties

These connect instances of classes together.

hasActor, hasDirector, hasWriter: Links a Movie to the People involved.

isActorOf, isDirectorOf, isWriterOf: Inverse properties, linking a Person to the Movies they participated in.

Data Properties

These assign data value to entities.

title, year, country, language: Describe characteristics of a Movie.

name, age, nationality, hasGenderType: Describe attributes of a Person.

3. Logic

The ontology employs OWL (Web Ontology Language) to define its structure and logic.

Restrictions

These define constraints on properties.

owl: someValuesFrom: Ensures a movie has at least one actor, director, writer, and genre.

owl: minQualifiedCardinality: Ensures each person is associated with at least one movie in each role (actor, director, writer).

Axioms

Explicit statements that define relationships and constraints.

owl: disjointWith: States that the classes "Movie" and "Person" are distinct and cannot have overlapping instances.

Inference Rules

OWL allows for reasoning and inferring new knowledge based on existing axioms and restrictions. Overall, this ontology provides a well-structured representation of movie-related data, using OWL to define classes, properties, and logical constraints. This enables the organization and retrieval of information about movies, genres, and individuals involved in filmmaking.

Class hierarchy

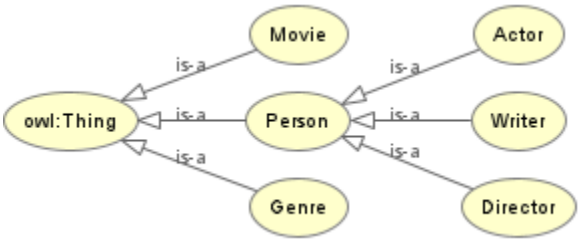


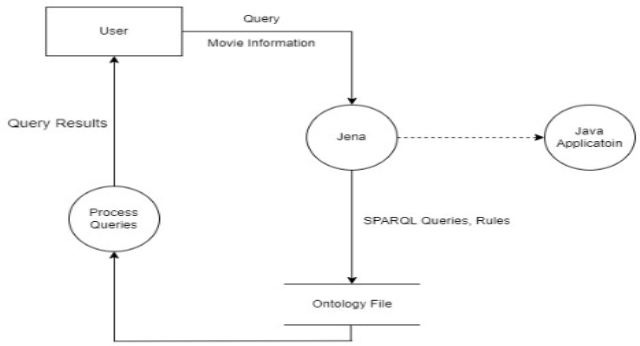
Figure 1: asserted hierarchy using OWLviz

Ontology visualization

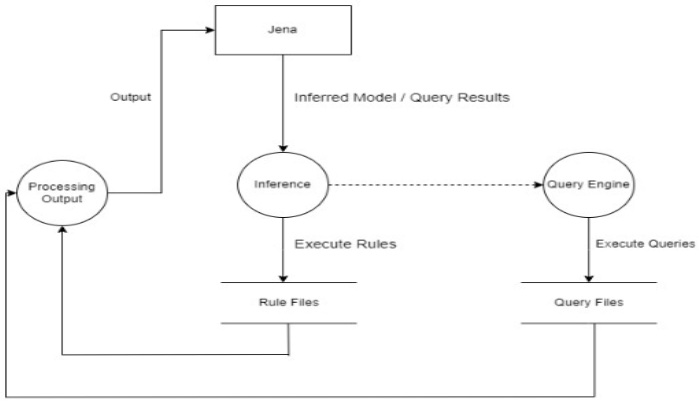
Click here to see the full visualization (RDF GRAPH)

Data Flow Diagram (DFD)

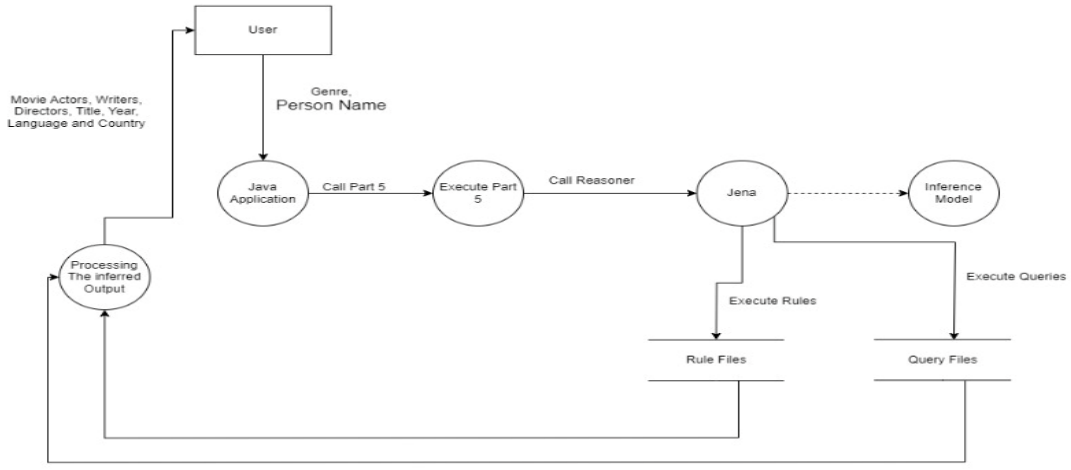
Level 0: Context Diagram



Level 1: System (Jena) Decomposition



Level 2: Java Application Decomposition



Part I & II:

.Owl file link on drive:
https://drive.google.com/file/d/1HHtH6Y9q4xbcvtq42M1ecy9n3aU2HkQz/view?usp=sharing

Part III: Querying the ontology

1.0 List the instances of the class Actor

Sparql:

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX : <http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/>

    SELECT ?actor
    WHERE {
      ?actor rdf:type :Actor .
    }
```

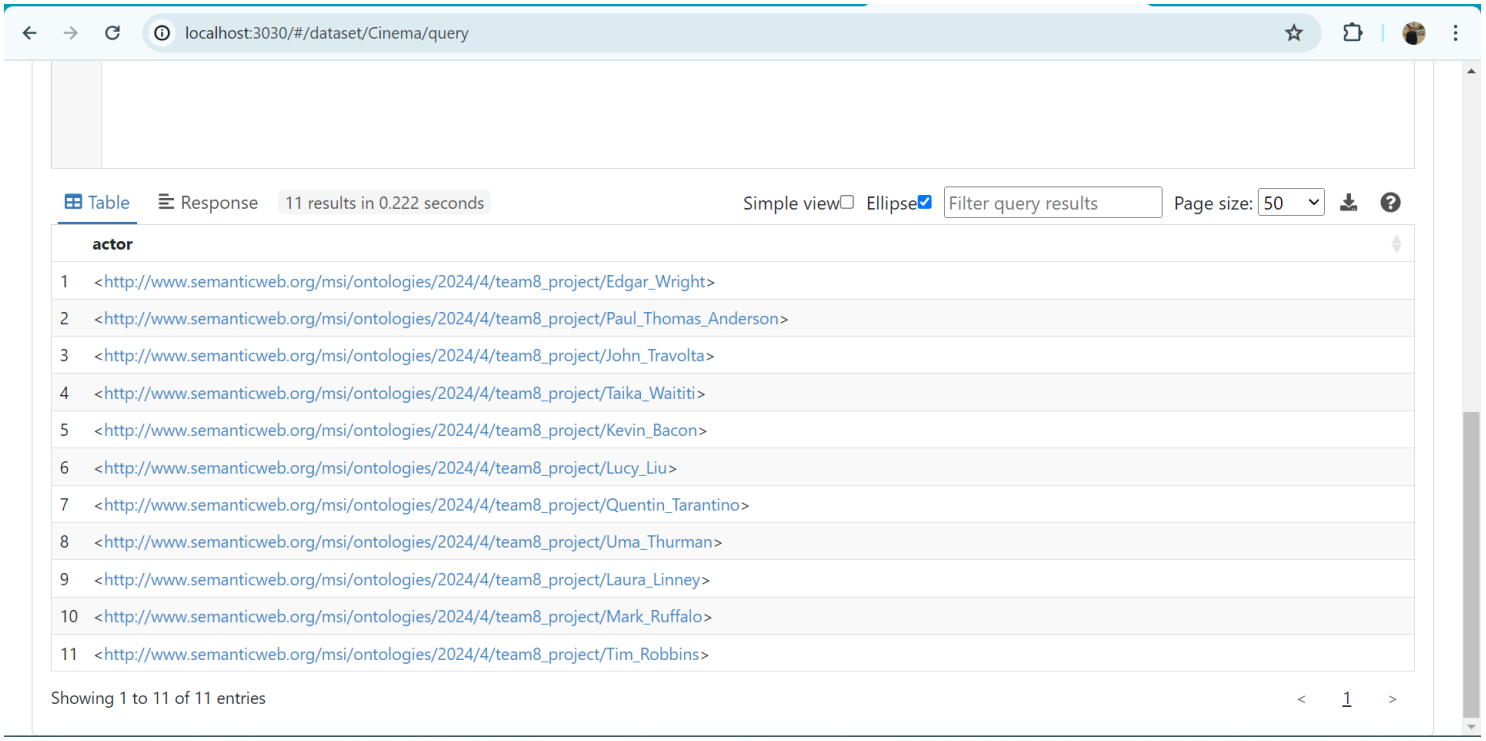


Figure 2: Testing on jena first sparql

2.0 List the instances of the class Writer

Sparql query:

```
SELECT ?writer
WHERE { ?writer rdf:type :Writer }
```

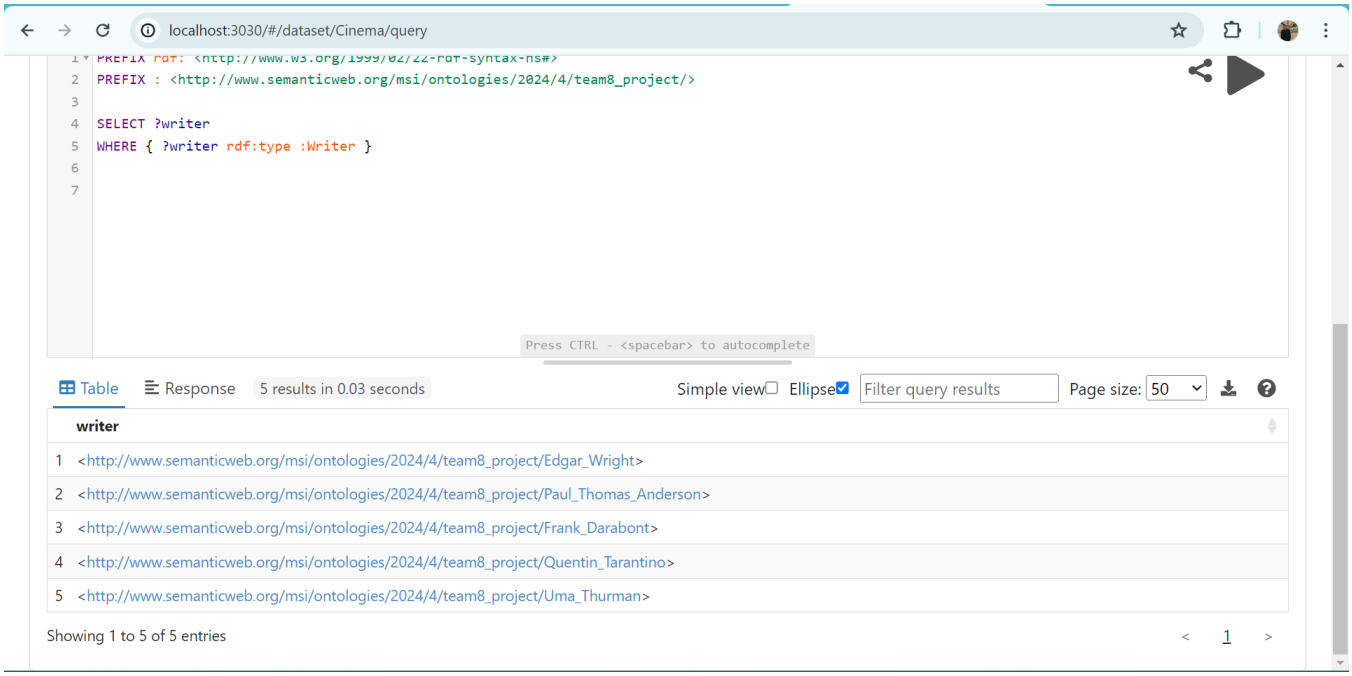


Figure 3:Testing on jena second SPARQL query

3.0 List the instances of the class Director

Sparql query:

```
SELECT ?director
WHERE { ?director rdf:type :Director }
```

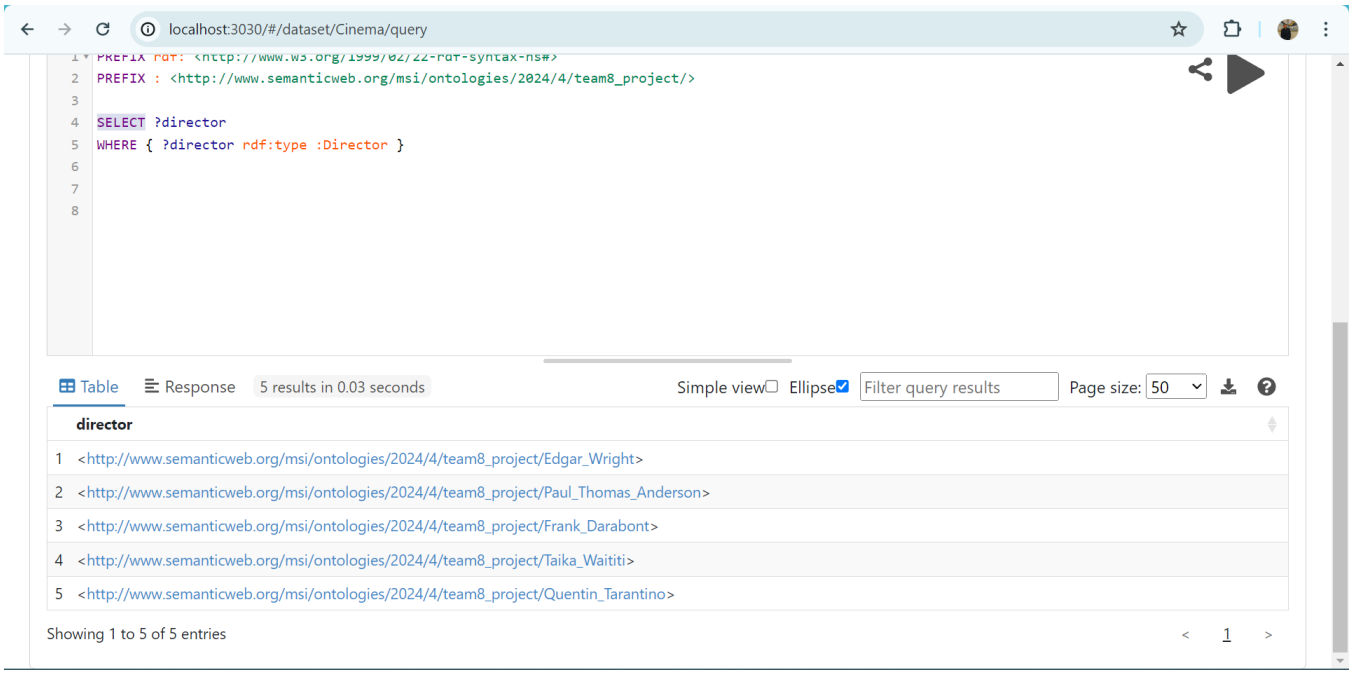


Figure 4: Testing on jena third SPARQL query

4.0 List the name of all Thriller movies and their directors

SPARQL query:

```
SELECT ?title ?directorName
WHERE {
 ?movie rdf:type :Movie ;
        :title ?title ;
        :hasGenre :Thriller ;
        :hasDirector ?director .
 ?director :name ?directorName .
}
```

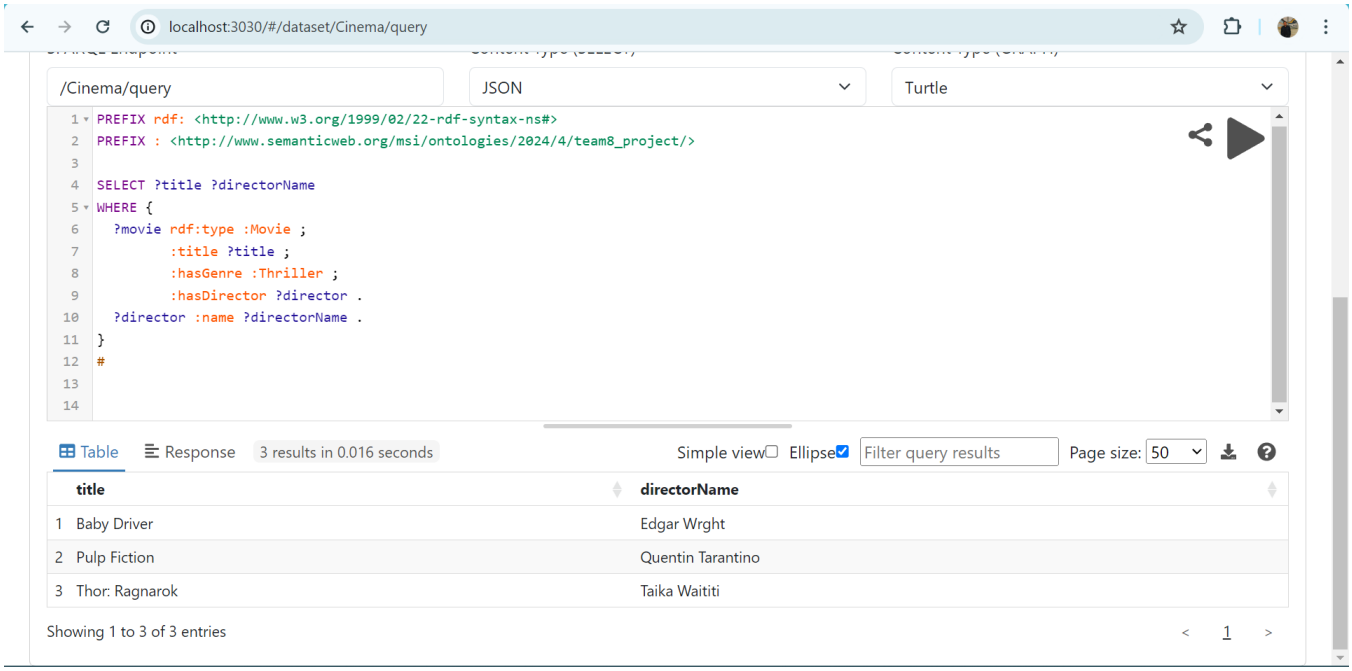


Figure 5: Testing on jena the fourth SPARQL query

5.0 List the name of all Crime Thriller movies

SPARQL query:

```
SELECT ?title
WHERE {
  ?movie rdf:type :Movie ;
        :title ?title ;
        :hasGenre :Crime, :Thriller .
}
```

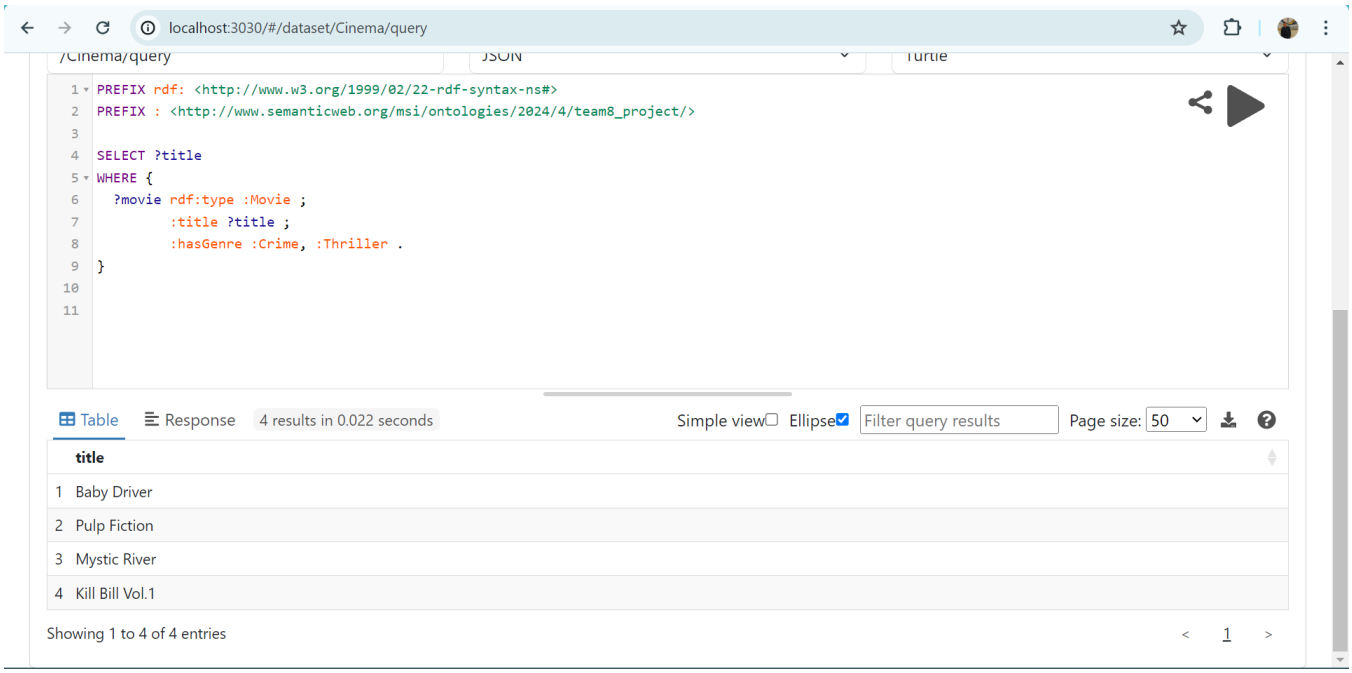


Figure 6: Testing on jena the fifth SPARQL query

6.0 List the male actors in a specific film (replace "Movie_Name" with the actual movie title)

SPARQL query:

Note: We try it for every movie for example: Mystic_River

```
SELECT ?actorName
WHERE {
  : Mystic_River :hasActor ?actor .
  ?actor :name ?actorName ;
        :hasGenderType "Male" .
}
```

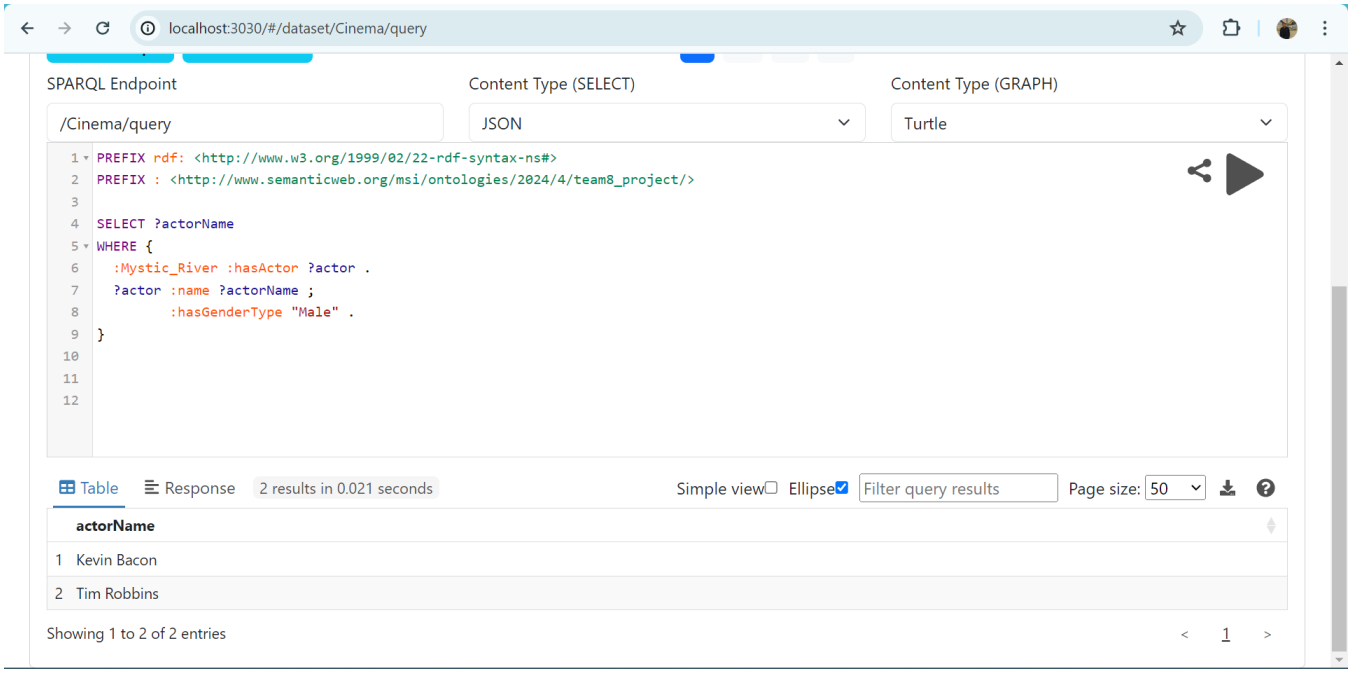


Figure 7: Testing on jena with Mystic_River movie

7.0 How many movies have both "Action" and "Thriller" as genres

SPARQL query:

```
SELECT (COUNT(?movie) AS ?count)
WHERE {
  ?movie rdf:type :Movie ;
         :hasGenre :Action, :Thriller .
}
```

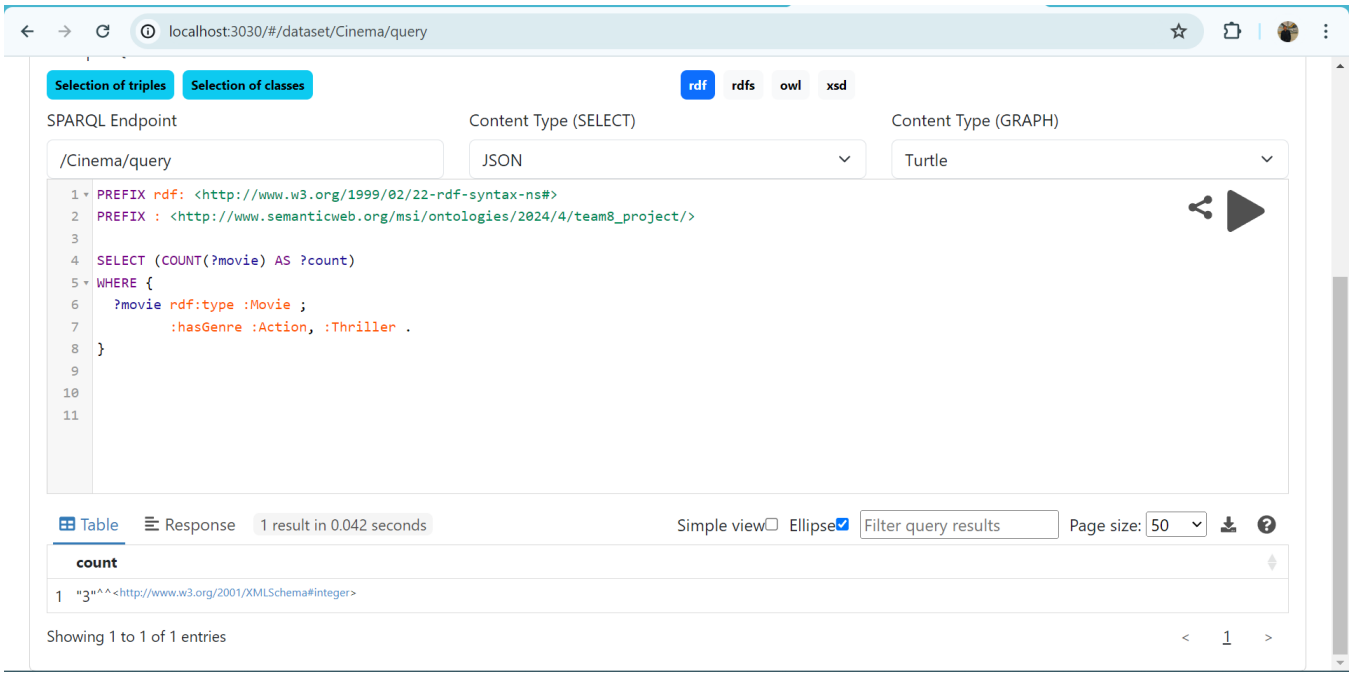


Figure 8: Testing on Jena that we have 3 Action Thriller movies

8.0 List all the movies written by a specific writer (replace "Writer_Name" with the actual writer name):

Note: We try it for every writer for example: Frank_Darabont
SPARQL query:

```
SELECT ?title
WHERE {
  ?movie rdf:type :Movie ;
         :title ?title ;
         :hasWriter :Frank_Darabont .
}
```

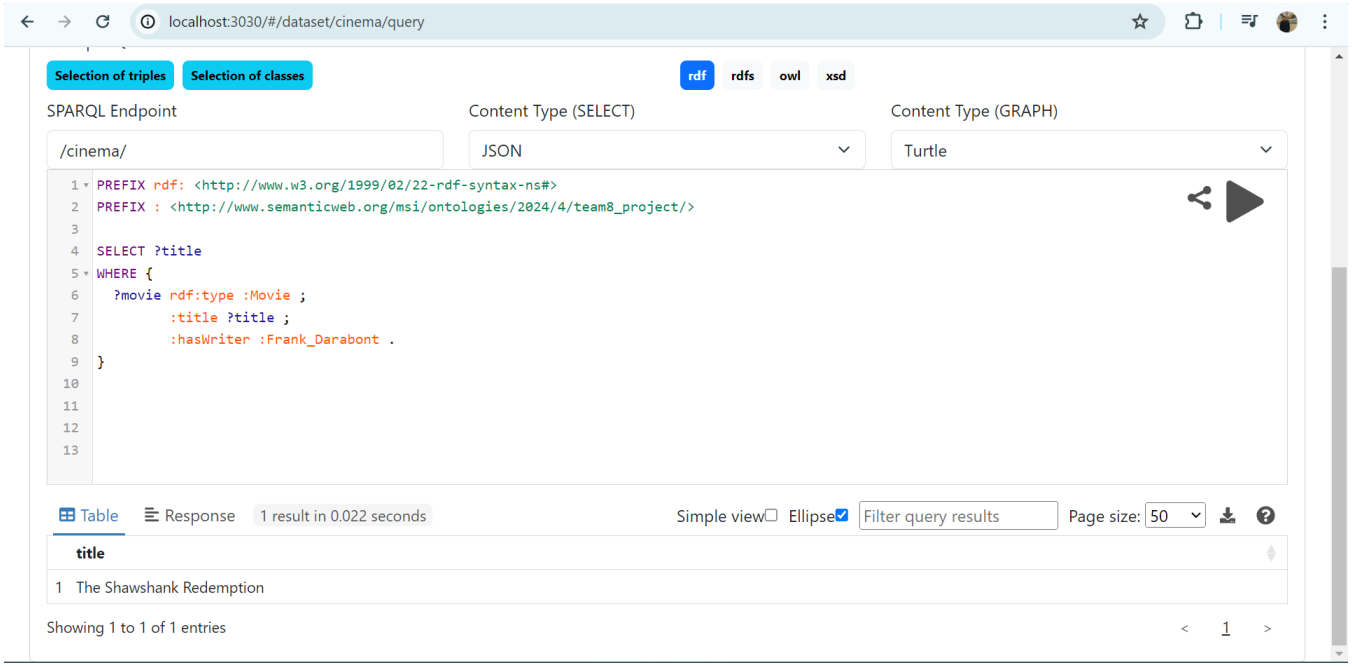


Figure 9: Testing on jena with Frank_Darabont as an example

9.0 Find movies with a certain language (replace "Language" with the actual language):

Note: We try it for every language for example: English

SPARQL query:

```
SELECT ?title
WHERE {
  ?movie rdf:type :Movie ;
         :title ?title ;
         :language "English" .
}
```

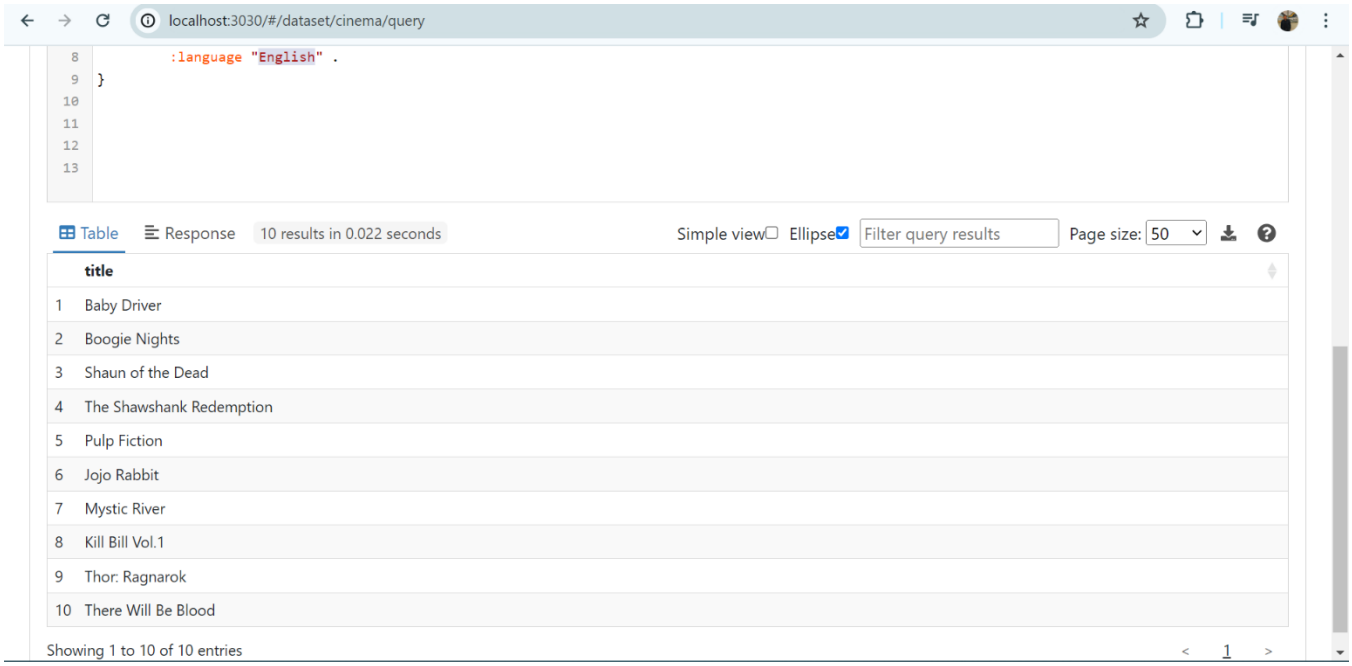


Figure 10: Testing on jena to get all english language movies

10.0 List the name of Actors older than 51 years:

SPARQL query:

```
SELECT ?name
WHERE {
  ?actor rdf:type :Actor ;
         :name ?name ;
         :age ?age .
  FILTER (?age > 51)
}
```

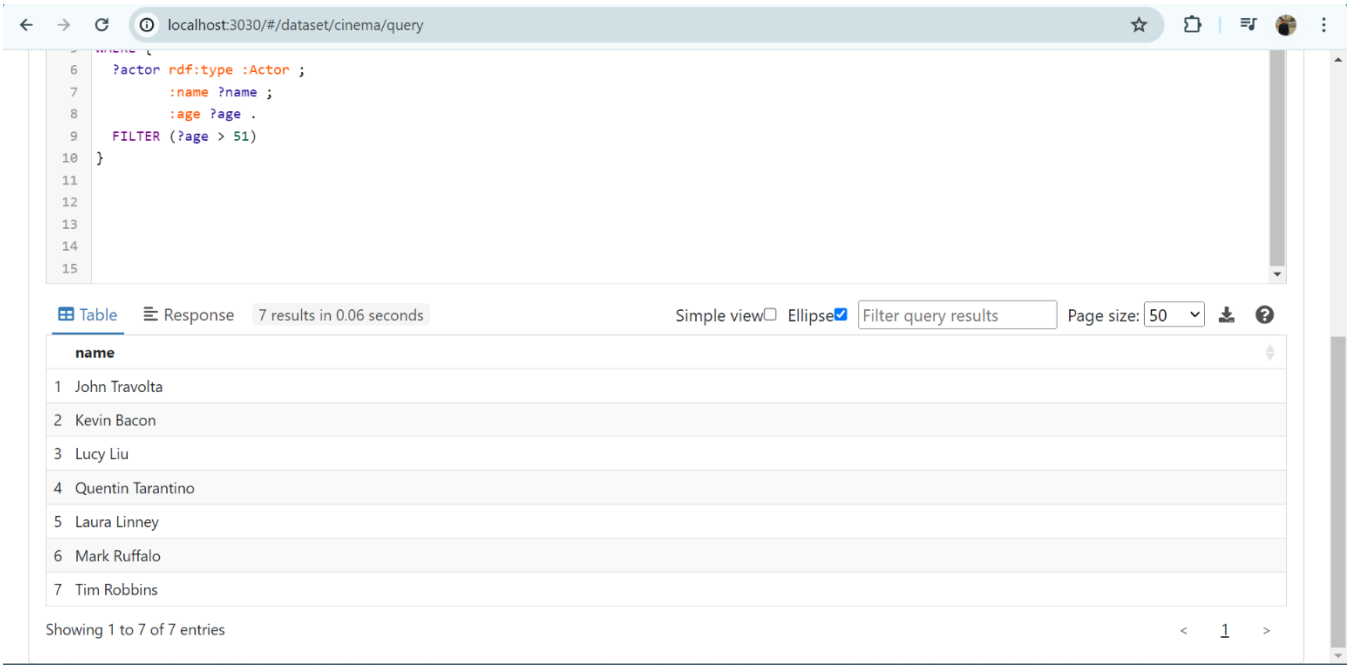


Figure 11: Testing on jena to get name of Actors older than 51 years

Proposed SPARQL Queries

1.0 Query with 2 Optional Graph Patterns

SPARQL query:

This query retrieves movies and optionally their directors and writers

```
SELECT ?title ?directorName ?writerName
WHERE {
  ?movie rdf:type :Movie ;
        :title ?title .
  OPTIONAL { ?movie :hasDirector ?director . ?director :name ?directorName }
  OPTIONAL { ?movie :hasWriter ?writer . ?writer :name ?writerName }
}
```

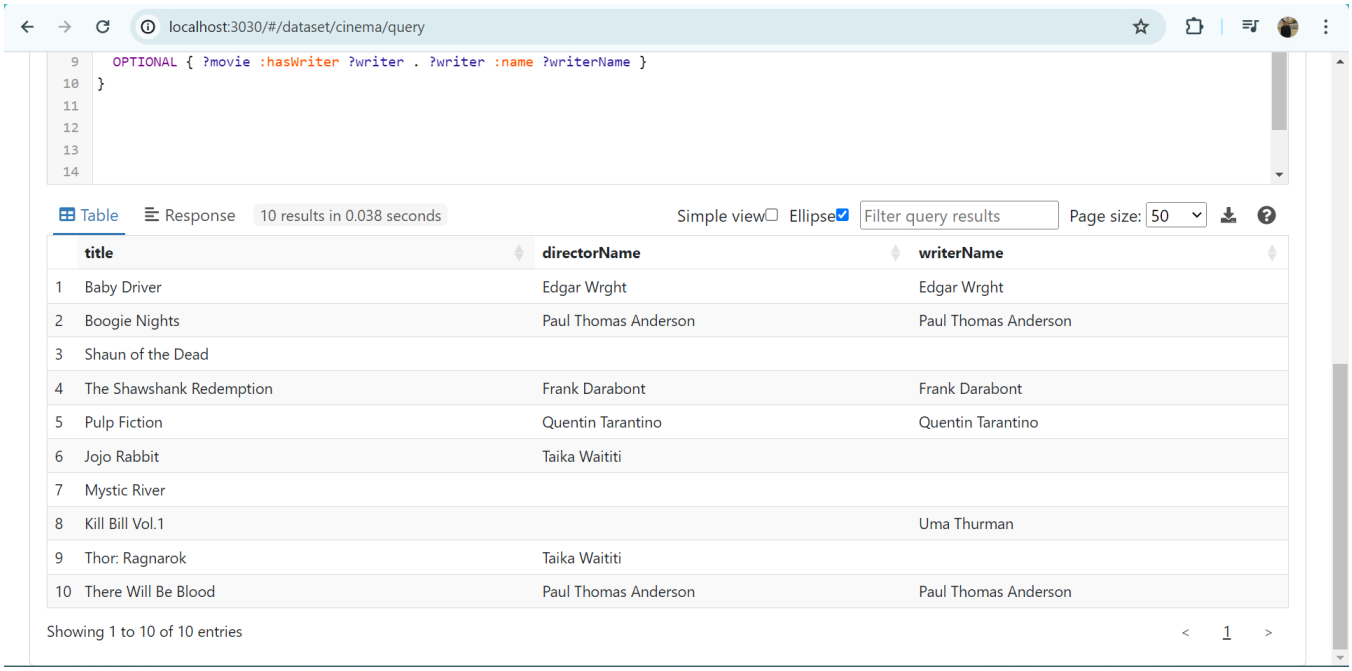


Figure 12: Testing the query on jena that retrieves movies and optionally their directors and writers

2.0 Query with 2 alternatives and conjunctions:

This query finds movies that are either Crime Thriller or Comedy Drama:

SPARQL query:

```
SELECT ?title
WHERE {
  { ?movie rdf:type :Movie ;
        :title ?title ;
        :hasGenre :Crime, :Thriller .
  }
  UNION
  { ?movie rdf:type :Movie ;
        :title ?title ;
        :hasGenre :Comedy, :Drama .
  }
}
```

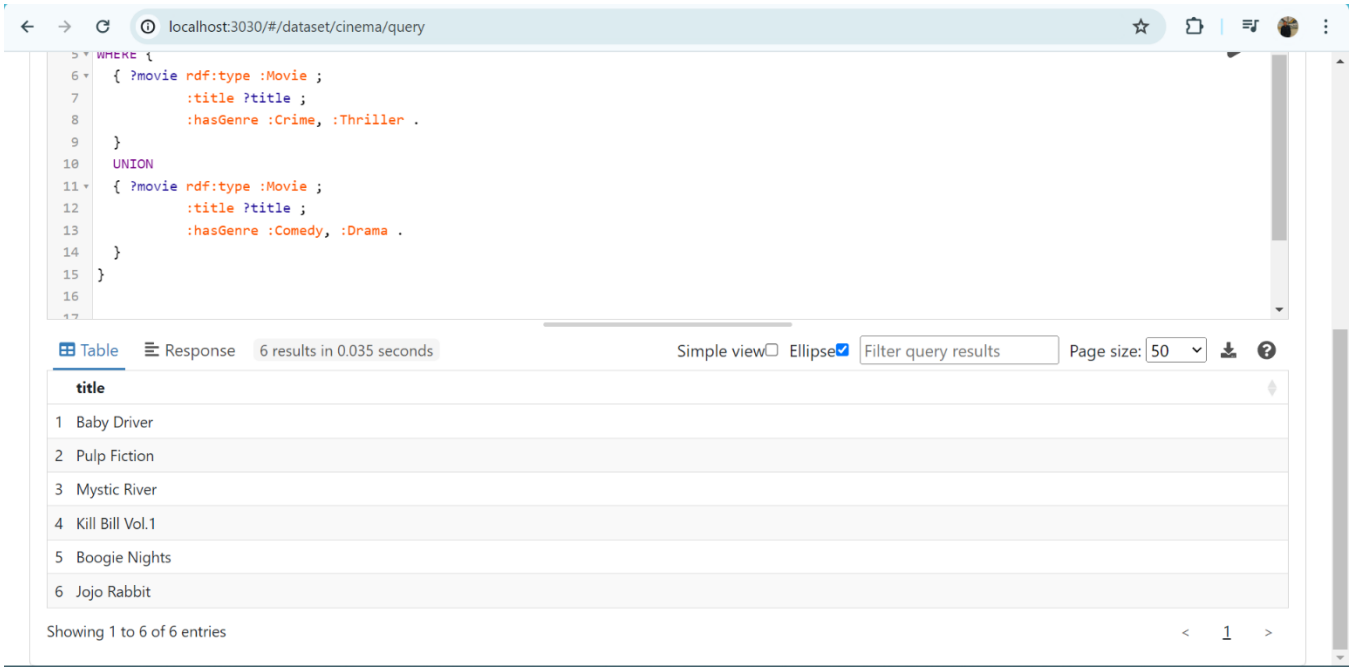


Figure 13: Testing on jena with 2 alternatives and conjunctions

3.0 CONSTRUCT Query:

This query constructs triples about movies and their genres:

SPARQL query

```
CONSTRUCT {
  ?movie :hasGenre ?genre .
}
WHERE {
  ?movie rdf:type :Movie .
  ?movie :hasGenre ?genre .
}
```

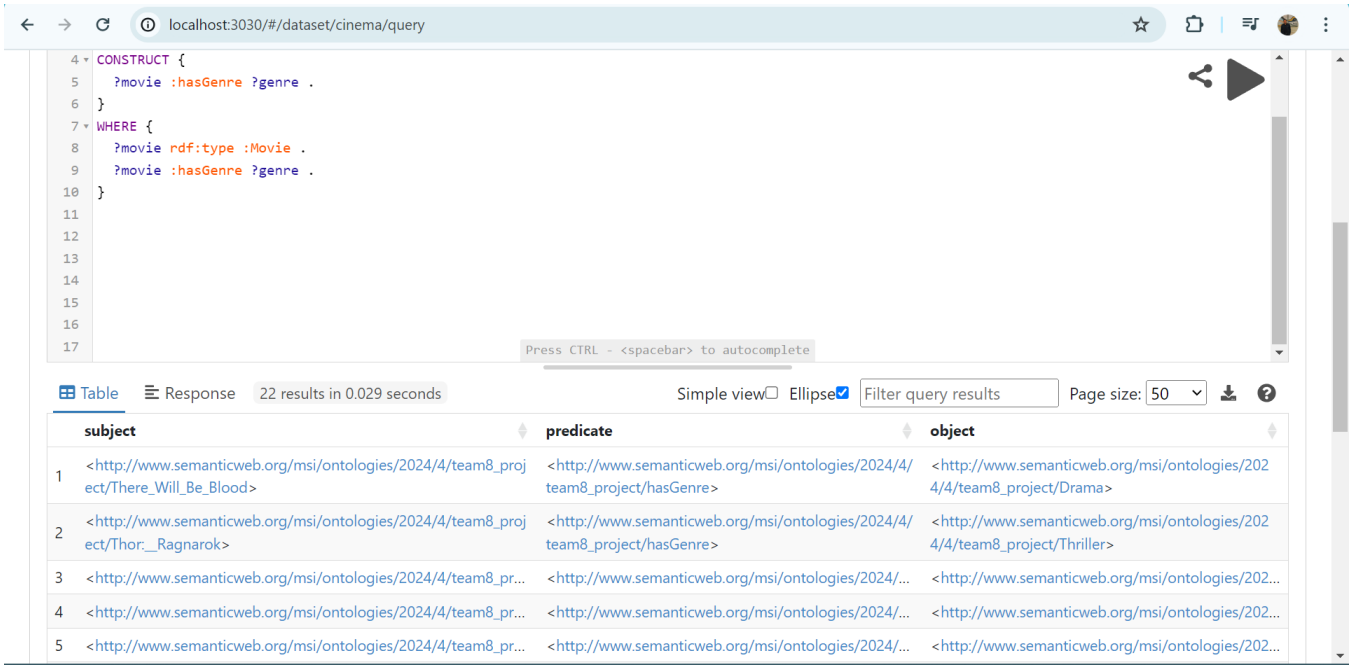


Figure 14: Testing the query with construction

4.0 ASK Query:

This query checks if there are any movies from the year 2003

SPARQL query

```
ASK {
  ?movie rdf:type :Movie ;
         :year 2003 .
}
```

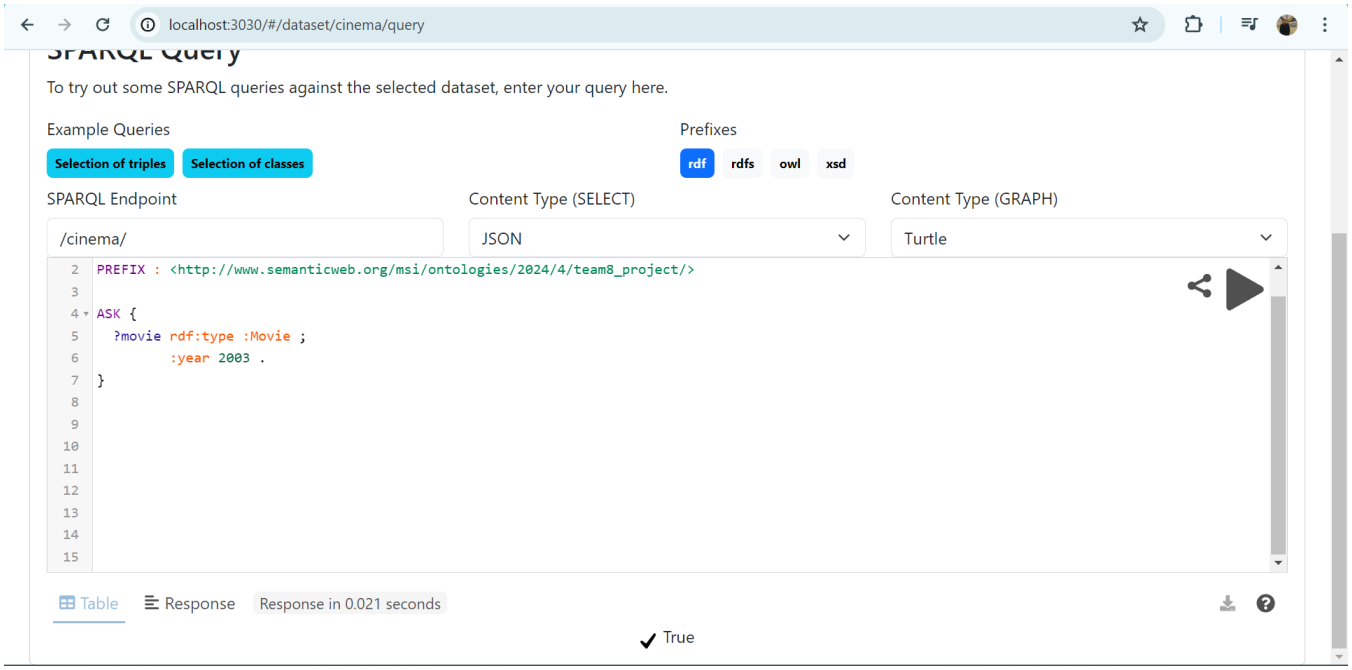


Figure 15: Testing in jena and the answer is "True"

5.0 DESCRIBE Query:

This query describes the resource "Quentin_Tarantino":

SPARQL query

```
DESCRIBE :Quentin_Tarantino
```

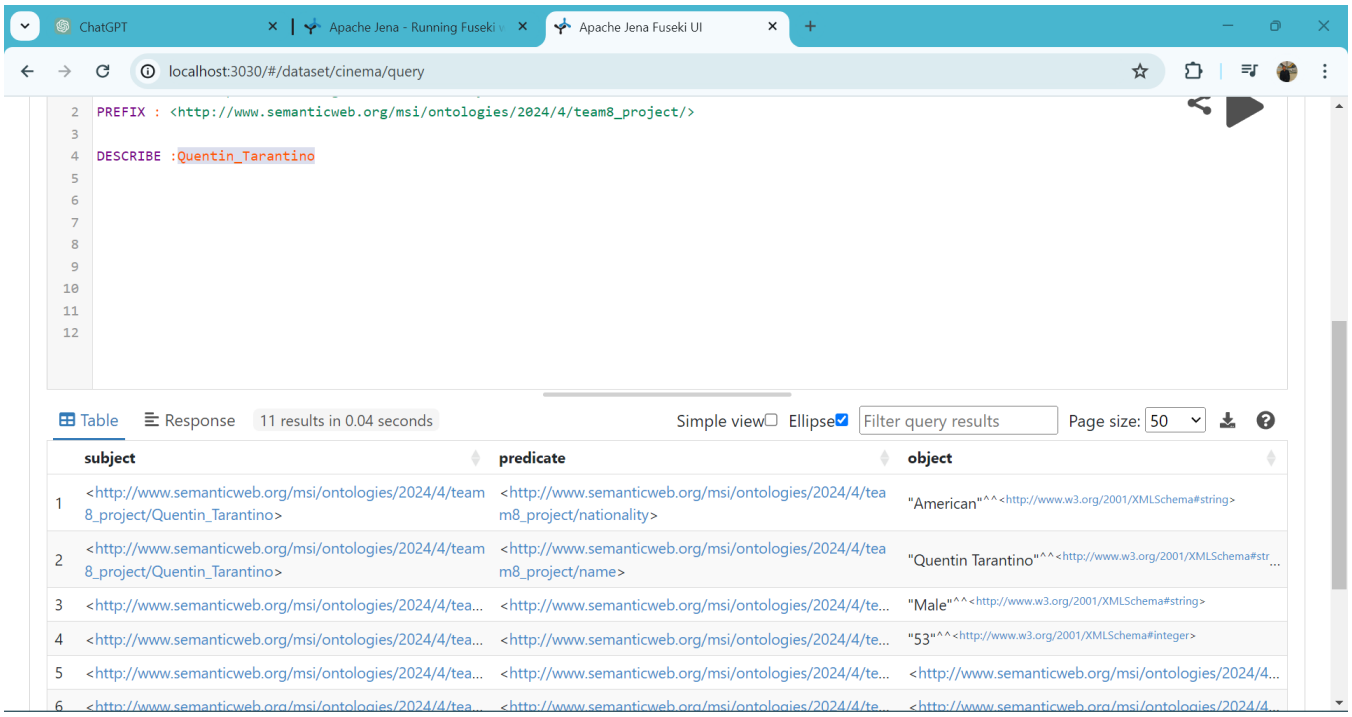


Figure 16: Testing on jena to describe all things about Quentin Tarantino

Part IV: Manipulating the ontology using Jena

1. Create a java program (Jena1.java) that loads the ontology and displays all the Persons (without using queries, without inference).

code:

```
import rdflib
from rdflib.namespace import OWL, RDF, RDFS
from SPARQLWrapper import SPARQLWrapper, JSON
from rdflib import Graph, Namespace, URIRef

# Load the ontology
g = Graph()
g.parse(r"C:\Users\Dell\Desktop\Cinema.rdf")

# Define the URIs for the subclasses
director_uri = URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Director")
writer_uri = URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Writer")
actor_uri = URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Actor")

# Find individuals that are instances of Director, Writer, or Actor
persons = set()
for s, p, o in g.triples((None, RDF.type, None)):
    if o in [director_uri, writer_uri, actor_uri]:
        persons.add(s)

# Print the results
for person in persons:
    print(person)
```

Output:

```
"C:\Users\Dell\Desktop\Ontology Project\Scripts\python.exe" "C:/Users/Dell/Desktop/Ontology
Project/Task 1.py"
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Laura_Linney
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Taika_Waititi
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Uma_Thurman
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Kevin_Bacon
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Tim_Robbins
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Edgar_Wright
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Frank_Darabont
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Lucy_Liu
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Paul_Thomas_Anderson
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/John_Travolta
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Quentin_Tarantino
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Mark_Ruffalo
```

Screenshot

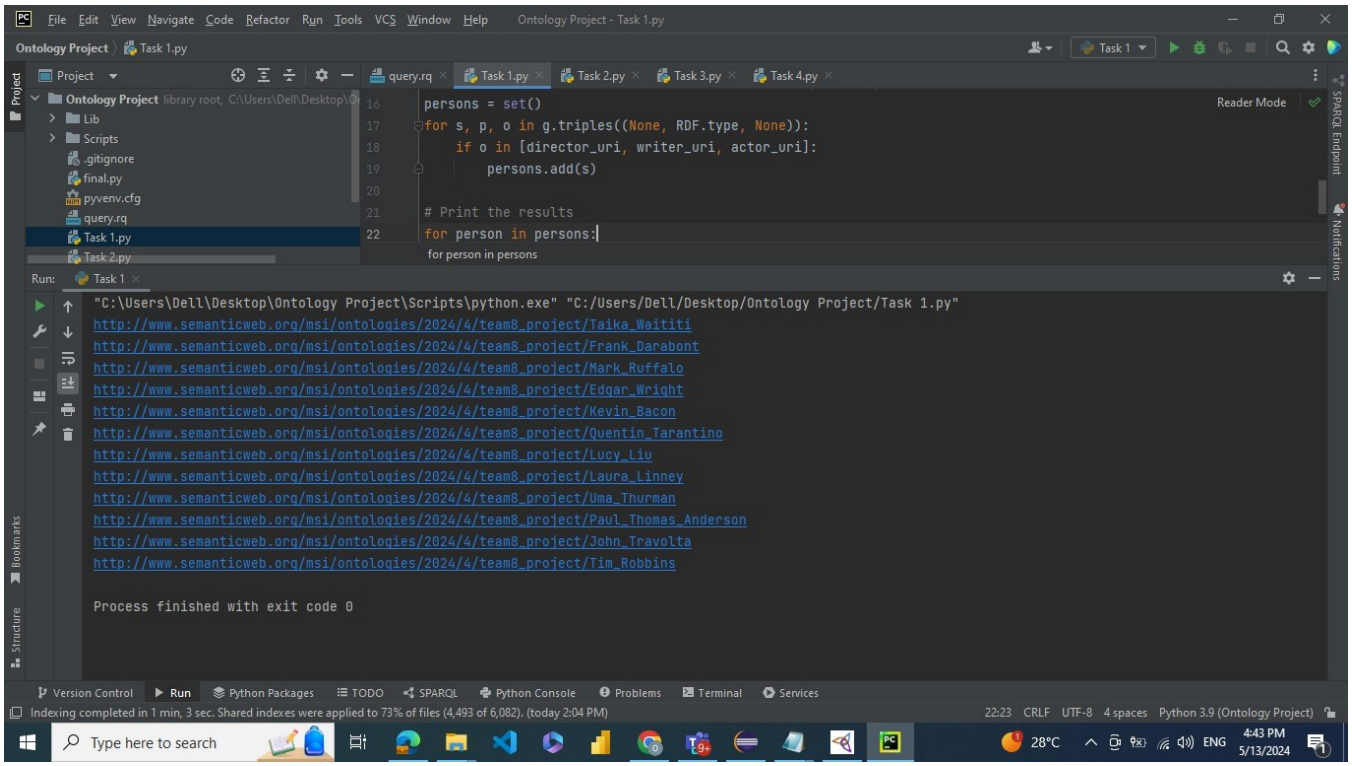


Figure 17: Screenshot of the output of task 1

2. Create a java program (Jena2.java) that loads the ontology and displays all the Persons (using a query, without inference). Create the used query in text file under the data folder.

Code:

```
from rdflib import Graph

# Load the ontology
g = Graph()
g.parse(r"C:\Users\Dell\Desktop\Cinema.rdf")

# Load the SPARQL query
with open(r"C:\Users\Dell\Desktop\Ontology Project\query.rq", "r") as f:
    query_string = f.read()

# Execute the query
results = g.query(query_string)

# Use a set to store unique results
unique_results = set()

# Store the results in the set
for row in results:
    unique_results.add(row.person)

# Print the unique results
for person in unique_results:
    print(person)
```

Output:

```
"C:\Users\Dell\Desktop\Ontology Project\Scripts\python.exe" "C:/Users/Dell/Desktop/Ontology
Project/Task 2.py"
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Lucy_Liu
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Edgar_Wright
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Paul_Thomas_Anderson
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Tim_Robbins
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Taika_Waititi
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Quentin_Tarantino
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Uma_Thurman
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Mark_Ruffalo
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Kevin_Bacon
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Frank_Darabont
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Laura_Linney
http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/John_Travolta
```

Query:

```
SELECT ?person
WHERE {
  ?person rdf:type/rdfs:subClassOf*
<http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Person>
}
```

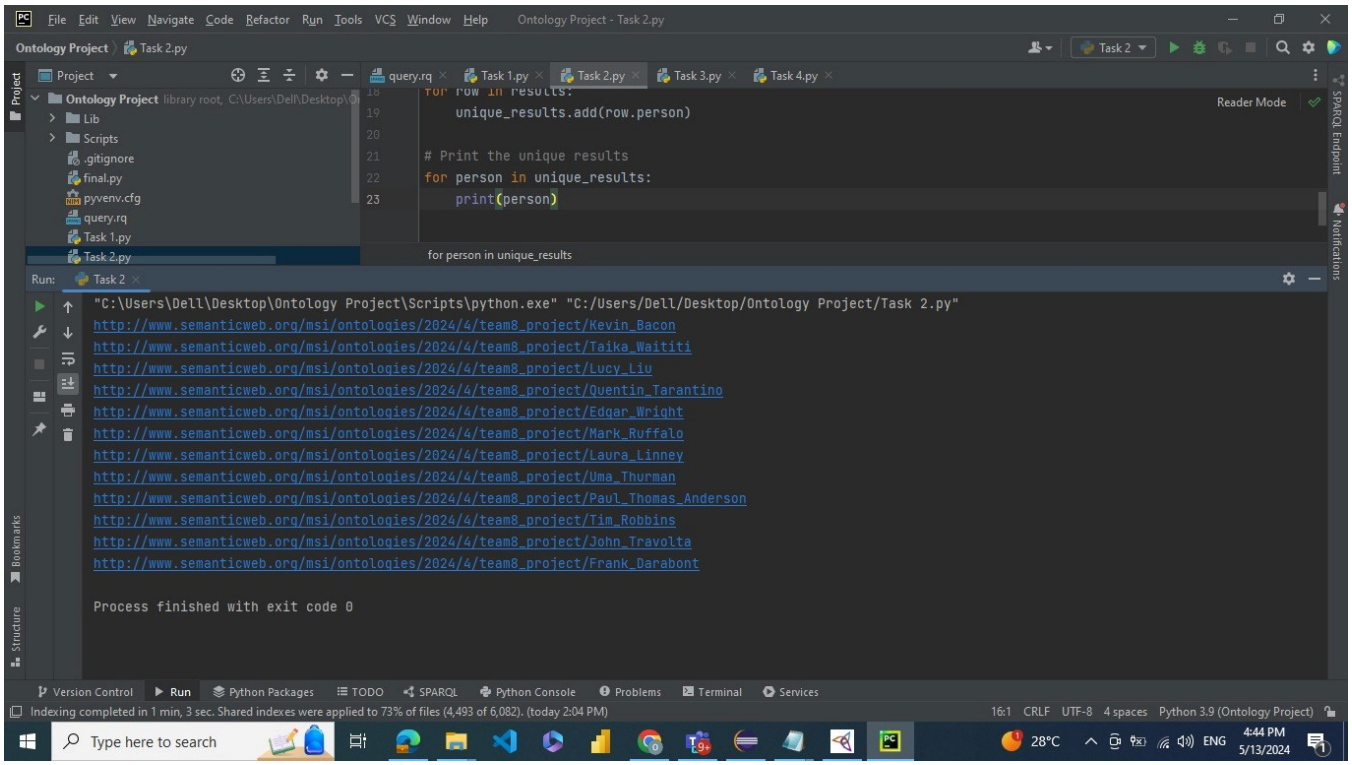


Figure 18: Screenshot of output of task 2

3. Create a java program (Jena3.java) that loads the ontology and displays all the Actors (without using queries, using inference). To load the inferred model, use the JenaEngine.readInferencedModelFromRuleFile method and use owl rules

Code

```
package pack;
import tools.JenaEngine;

import org.apache.jena.rdf.model.Model;
import org.apache.jena.rdf.model.Property;
import org.apache.jena.rdf.model.ResIterator;
import org.apache.jena.rdf.model.Resource;

public class Task3 {

	private Model model;
	private String file;
	private String namespace;

	Task3(String path){
		this.namespace = "";
		this.file = path;
		this.model = JenaEngine.readModel(path);
		if(model != null ){
			namespace = model.getNsPrefixURI("");
		}

	}

	public void readActor(){
		Model ourmodel = JenaEngine.readInferencedModelFromRuleFile(model,
"Ontology/rule3.txt");
		Property pname = model.getProperty(namespace + "name");
		ResIterator iter =ourmodel.listResourcesWithProperty(pname);
		for (; iter.hasNext();) {
			Resource i = iter.next();
			JenaEngine.readRsDataType(ourmodel, namespace, i, "name");
		}

	}

}
```

rule

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix : <http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/> .

[rule: (?per rdf:type :Actor) ->(?per rdf:type A)]

Output

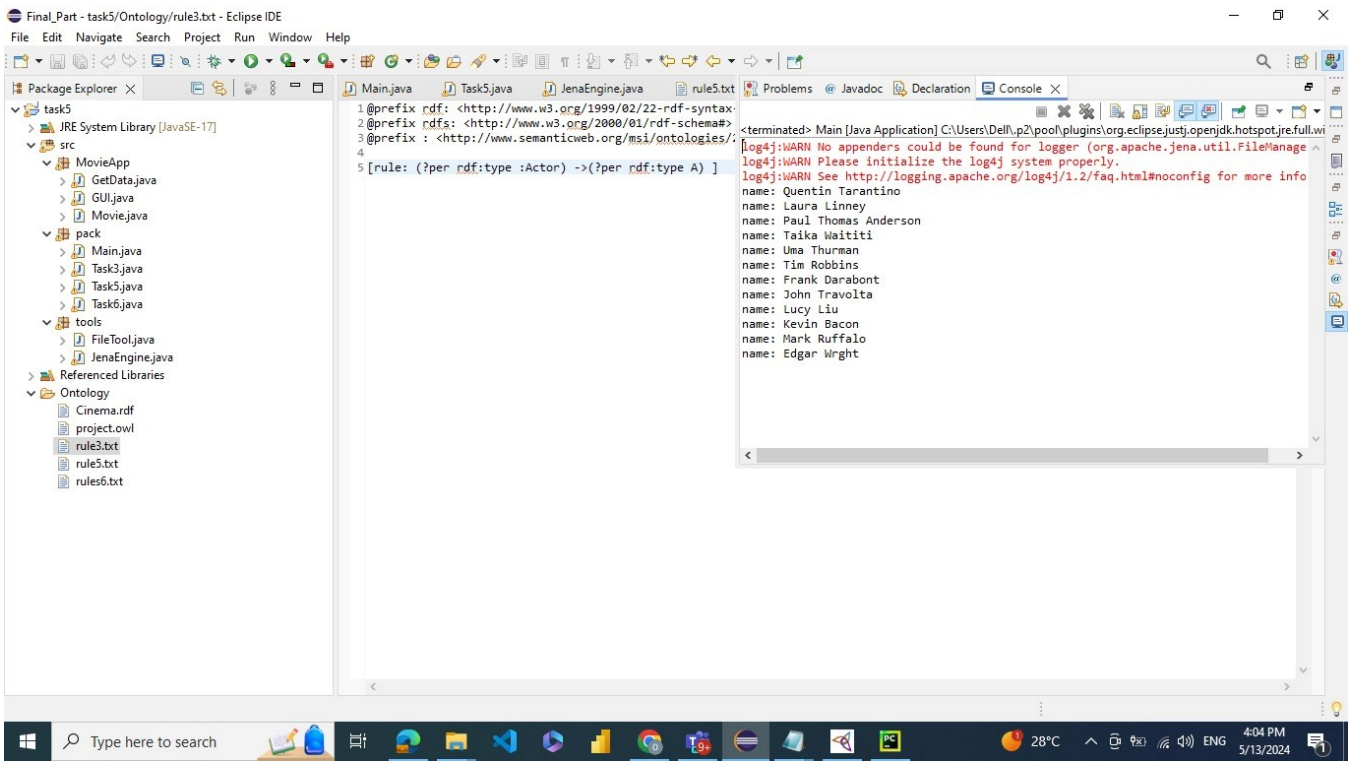


Figure 19: Screenshot of the output task 3

4. Create a java program (Jena4.java) that: a. Reads a name of a movie b. If it doesn't exist displays an error message c. Else, display its year, country, genres and actors

Code

```
from rdflib import Graph, URIRef
from rdflib.namespace import OWL, RDF, RDFS

def get_movie_info(movie_title):
    # Load the ontology
    g = Graph()
    g.parse(r"C:\Users\Dell\Desktop\Cinema.rdf")

    # Find the movie
    movie = URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/" + movie_title)
    if (movie, RDF.type,
URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/Movie")) not in g:
        print("Movie not found!")
        return

    # Get movie details
    year = g.value(movie,
URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/year"))
    country = g.value(movie,
URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/country"))
    genres = g.objects(movie,
URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/hasGenre"))
    actors = g.objects(movie,
URIRef("http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/hasActor"))

    # Print movie information
    print(f"Title: {movie_title}")
    print(f"Year: {year}")
    print(f"Country: {country}")
    print("Genres:")
    for genre in genres:
        print(f"\t- {genre}")
    print("Actors:")
    for actor in actors:
        print(f"\t- {actor}")

# Example usage
get_movie_info("")
```

Output

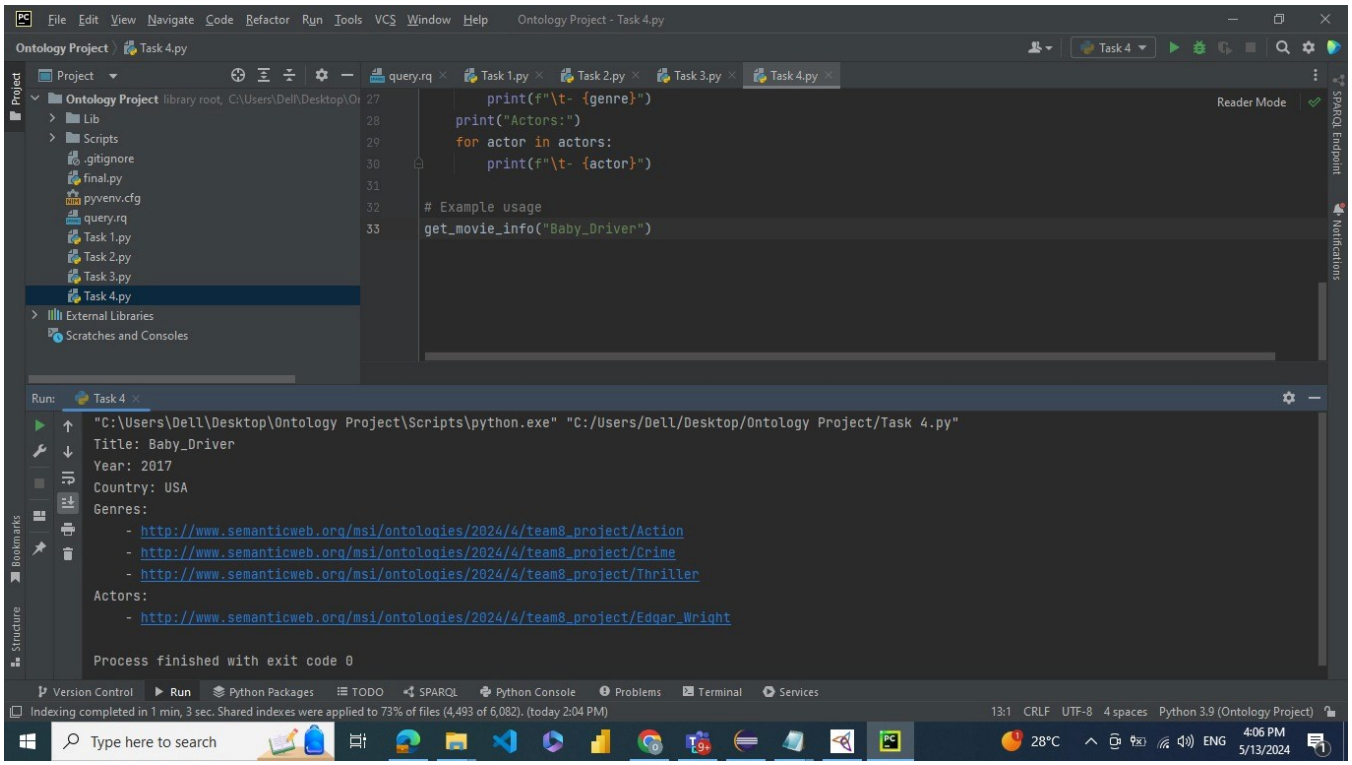


Figure 20: Screenshot of Output task 4

5. Create a java program (Jena5.java) that displays all persons that are actors and directors. Do this using a rule that defines a new class ActorDirector. The rule file must be saved in the data folder.

Code

```
package pack;
import tools.JenaEngine;

import org.apache.jena.rdf.model.Model;
import org.apache.jena.rdf.model.Property;
import org.apache.jena.rdf.model.ResIterator;
import org.apache.jena.rdf.model.Resource;
public class Task5 {

	private Model model;
	private String file;
	private String namespace;

	Task5(String path){
		this.namespace = "";
		this.file = path;
		this.model = JenaEngine.readModel(path);
		if(model != null ){
			namespace = model.getNsPrefixURI("");
		}
	}

	public void readActorDirector(){
		//this.model = JenaEngine.readInferencedModelFromRuleFile(model,
"Ontology/owlrules.txt");
		this.model = JenaEngine.readInferencedModelFromRuleFile(model,
"Ontology/rule5.txt");

		String query = "PREFIX :
<http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/>"
				+ "PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>"
				+ "PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>"
				+ "SELECT ?person  "
				+ "WHERE{"
				+ "?person rdf:type :ActorDirector. " + "}";
		System.out.println(JenaEngine.executeQuery(model, query));
	}



}
```

rule

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix : <http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/> .

[rule1: (?per rdf:type :Actor), (?per rdf:type :Director) -> (?per rdf:type :ActorDirector)]

Output

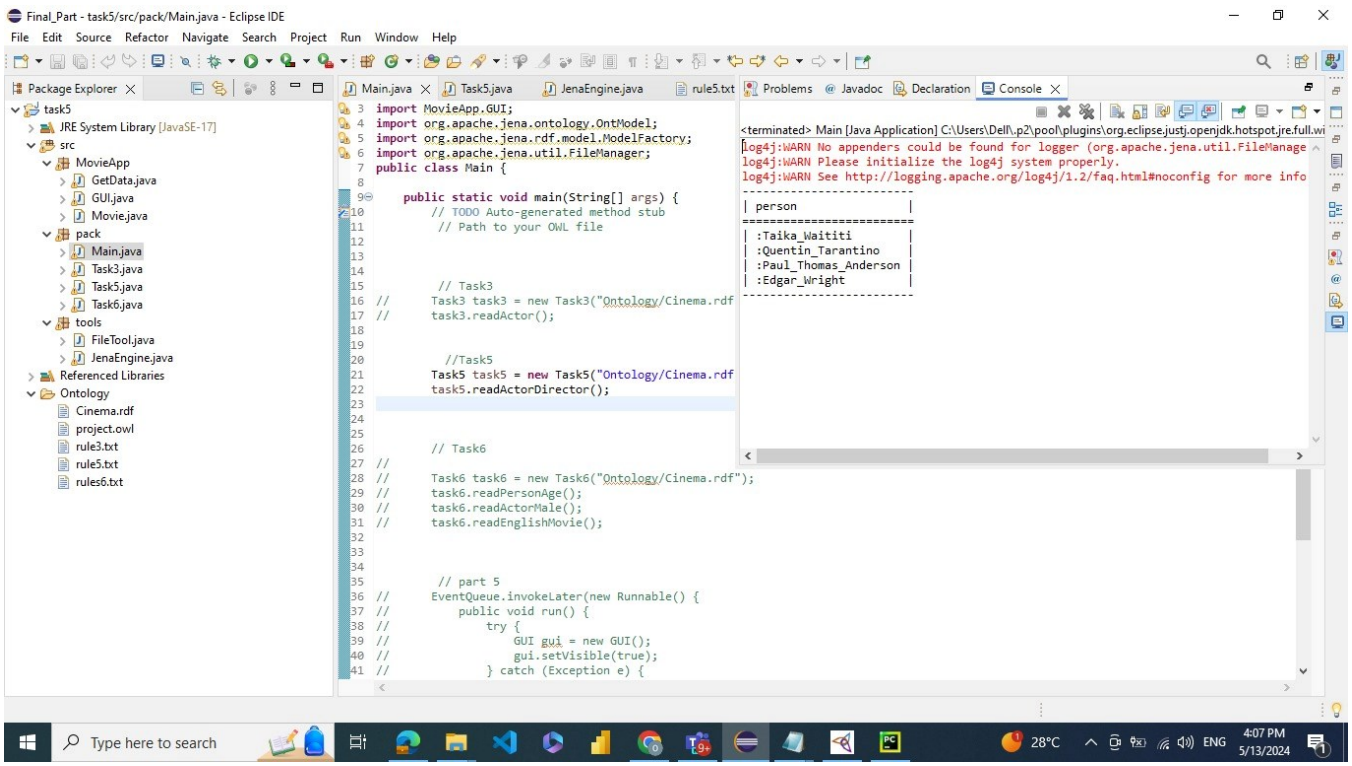


Figure 21: Screenshot of the output task 5

6. Specify 3 different rules and implement them in a java program (Jena6.java)

Code

```
package pack;
import tools.JenaEngine;

import org.apache.jena.rdf.model.Model;
import org.apache.jena.rdf.model.Property;
import org.apache.jena.rdf.model.ResIterator;
import org.apache.jena.rdf.model.Resource;
public class Task6 {

	private Model model;
	private String file;

	Task6(String path) {
		this.file = path;
		this.model = JenaEngine.readModel(file);

		//this.model = JenaEngine.readInferencedModelFromRuleFile(model,
			//	"data/owlrules.txt");
		this.model = JenaEngine.readInferencedModelFromRuleFile(model,
				"Ontology/rules6.txt");
	}

	public void readPersonAge() {
		String query = "PREFIX :
<http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/>"
				+ "PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>"
				+ "PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>"
				+ "SELECT ?person ?age "
				+ "WHERE{"
				+ "?person rdf:type :PersonAge. ?person :age ?age." + "}";
		System.out.println(JenaEngine.executeQuery(model, query));
	}

	public void readActorMale() {
		String query = "PREFIX :
<http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/>"
				+ "PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>"
				+ "PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>"
				+ "SELECT ?person ?gender "
				+ "WHERE{"
				+ "?person rdf:type :ActorMale. ?person :hasGenderType ?gender."
				+ "}";
		System.out.println(JenaEngine.executeQuery(model, query));
	}
```

```
	public void readEnglishMovie() {
		String query = "PREFIX :
<http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/>"
				+ "PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>"
				+ "PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>"
				+ "SELECT ?movie ?year ?language "
				+ "WHERE{"
				+ "?movie rdf:type :EnglishMovie. ?movie :year ?year.  ?movie :language
?language ."
				+ "}";
		System.out.println(JenaEngine.executeQuery(model, query));
	}


}
```

rules

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix : <http://www.semanticweb.org/msi/ontologies/2024/4/team8_project/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

[rule1: (?per rdf:type :Actor)  (?per :age ?age)  lessThan(?age, 55)-> (?per rdf:type :PersonAge)]
[rule2: (?per rdf:type :Actor)   (?per :hasGenderType "Male")-> (?per rdf:type :ActorMale)]
[rule3: (?per rdf:type :Movie)   (?per :language "English") -> (?per rdf:type :EnglishMovie)]
```

Output

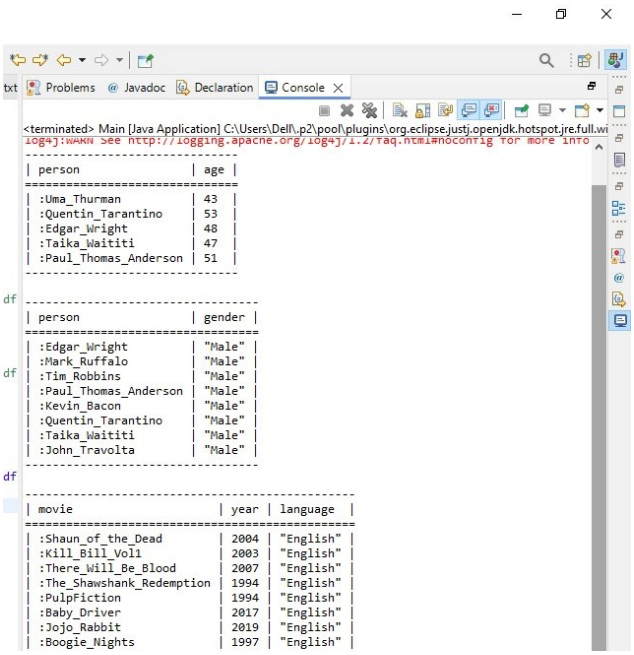


Figure 22: Screenshot of the output task 6

Part V: Java application

Overview

This Java application allows users to search for movies based on genre and individuals involved in the film industry (actors, directors, writers). Here's a breakdown of its components:

1. Movie.java:

This class defines the structure of a Movie object.

It stores information such as:

- title
- year
- language
- nation (country of origin)

It provides getters and setters to access and modify these attributes.

2. GetData.java:

This class interacts with an RDF knowledge base (Ontology/Cinema.rdf) using the Jena library.

- The getFilmData method retrieves information from the knowledge base based on two inputs:
- name: The name of a genre, actor, director, or writer.
- property: The relationship to search for (e.g., "hasGenre", "isActorOf").
- It queries the knowledge base to find movies related to the given name and property.
- It returns an ArrayList of Movie objects populated with data from the knowledge base.

3. GUI.java:

This class creates the user interface using Swing components.

It includes:

- Text areas for entering genre and person's name.
- Buttons for searching and clearing data.
- Four tables to display the search results:
    a. Filmlist based on genre.
    b. Films as an actor.
    c. Films as a director.
    d. Films as a writer.
- The initTable method sets up the column names for the tables.
- The setData method populates the tables with data retrieved from the GetData class.

- The clearData method clears the contents of the tables.

How the Application Works:

1. User Input: The user enters a genre in the genre text area and/or a person's name in the actor text area.
2. Search: When the user clicks the "search" button:
    - The GUI class calls the getFilmData method from the GetData class.
    - The getFilmData method queries the knowledge base for relevant movies.
    - The results are returned to the GUI class as an ArrayList of Movie objects.
3. Display Results: The GUI class uses the setData method to populate the appropriate tables with the retrieved movie data.
4. Clear: The "clear" button clears the user input and the contents of the tables.

In summary: This application provides a graphical interface for querying a semantic knowledge base about movies. Users can search based on genre and the roles of individuals in the film industry. The results are presented in an organized tabular format.

Code

Movie.java Code:

```
package MovieApp;

public class Movie {

	private String title;
	private String year;
	private String language;
	private String nation;

	public Movie(String title) {
		super();
		this.title = title;
	}

	public String getTitle() {
		return title;
	}

	public void setTitle(String title) {
		this.title = title;
	}

	public String getYear() {
		return year;
	}

	public void setYear(String year) {
		this.year = year;
	}

	public String getLanguage() {
		return language;
	}

	public void setLanguage(String language) {
		this.language = language;
	}

	public String getNation() {
		return nation;
	}

	public void setNation(String nation) {
		this.nation = nation;
	}

}
```

GetData.java Code:

```
package MovieApp;

import java.util.ArrayList;

import tools.JenaEngine;

import org.apache.jena.rdf.model.Model;
import org.apache.jena.rdf.model.Property;
import org.apache.jena.rdf.model.Resource;
import org.apache.jena.rdf.model.Statement;
import org.apache.jena.rdf.model.StmtIterator;

public class GetData {
	private Model model;
	private String namespace;
	private String file;

	public GetData() {
		namespace = "";
		file = "Ontology/Cinema.rdf";
		setModel();
		if (model != null) {
			namespace = model.getNsPrefixURI("");
		}
	}

	public void setModel() {
		this.model = JenaEngine.readModel("Ontology/Cinema.rdf");
	}

	public ArrayList getFilmData(String name, String property){
		Resource rs = model.getResource(namespace + name);
		Property p = model.getProperty(namespace + property);
		Property ptitle = model.getProperty(namespace + "title");
		Property pyear = model.getProperty(namespace + "year");
		Property plang = model.getProperty(namespace + "language");
		Property pnation = model.getProperty(namespace + "country");
		ArrayList result = new ArrayList();

		if ((rs != null) && (p != null)) {
			StmtIterator it = rs.listProperties(p);
			while (it.hasNext()) {
				Statement s = it.next();
				Resource re = s.getResource();
				String title = re.getProperty(ptitle).getString();
				Movie temp = new Movie(title);
				temp.setLanguage(re.getProperty(plang).getString());
```

```
                                temp.setYear(re.getProperty(pyear).getString());
                                temp.setNation(re.getProperty(pnation).getString());
                                result.add(temp);
                        }
                        return result;
                } else {
                        return result;
                }
        }

}
```

GUI Code:

```
package MovieApp;

import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;

import java.util.ArrayList;
import java.util.Vector;

import javax.swing.JButton;
import javax.swing.JFrame;
import javax.swing.JLabel;
import javax.swing.JScrollPane;
import javax.swing.JTable;
import javax.swing.JTextArea;
import javax.swing.table.DefaultTableModel;

public class GUI extends JFrame {

        private JTextArea genre;
        private JTextArea actortext;

        private GetData data;
        private DefaultTableModel filmTableModel;
        private DefaultTableModel actorTableModel;
        private DefaultTableModel directorTableModel;
        private DefaultTableModel writerTableModel;

        private JTable filmTable;
        private JTable actorTable;
        private JTable directorTable;
        private JTable writerTable;

        private Vector filmVectorData;
        private Vector actorVectorData;
        private Vector directorVectorData;
```

```
private Vector writerVectorData;
private Vector filmVectorColName;


public GUI() {
	super();
	getContentPane().setLayout(null);
	setBounds(100, 100, 800, 500);
	setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
	data = new GetData();

	//clear data in the input and table
	final JButton buttonClear = new JButton();
	buttonClear.addActionListener(new ActionListener() {
		public void actionPerformed(final ActionEvent e) {
			genre.setText(null);
			actortext.setText(null);
			clearData();
		}
	});
	buttonClear.setText("clear");
	buttonClear.setBounds(500, 390, 106, 28);
	getContentPane().add(buttonClear);

	//initial vectors
	filmVectorColName = new Vector();
	filmVectorData = new Vector();
	actorVectorData = new Vector();
	directorVectorData = new Vector();
	writerVectorData = new Vector();

	initTable();

	filmTableModel = new DefaultTableModel();
	filmTableModel.setDataVector(filmVectorData,filmVectorColName);
	filmTable = new JTable(filmTableModel);

	actorTableModel = new DefaultTableModel();
	actorTableModel.setDataVector(actorVectorData,filmVectorColName);
	actorTable = new JTable(actorTableModel);

	directorTableModel = new DefaultTableModel();
	directorTableModel.setDataVector(directorVectorData,filmVectorColName);
	directorTable = new JTable(directorTableModel);

	writerTableModel = new DefaultTableModel();
	writerTableModel.setDataVector(writerVectorData,filmVectorColName);
	writerTable = new JTable(writerTableModel);

	//button search
```

```
		final JButton buttonSearch = new JButton();
		buttonSearch.addActionListener(new ActionListener() {
			public void actionPerformed(final ActionEvent e) {
				clearData();

				String str = genre.getText();
				ArrayList filmlist = data.getFilmData(str, "hasGenre");
				setData(filmlist,filmVectorData);
				filmTable.invalidate();
				filmTable.updateUI();

				String pname = actortext.getText();
				ArrayList actfilmlist = data.getFilmData(pname, "isActorOf");
				setData(actfilmlist,actorVectorData);
				actorTable.invalidate();
				actorTable.updateUI();

				ArrayList direfilmlist = data.getFilmData(pname, "isDirectorOf");
				setData(direfilmlist,directorVectorData);
				directorTable.invalidate();
				directorTable.updateUI();

				ArrayList writerfilmlist = data.getFilmData(pname, "isWriterOf");
				setData(writerfilmlist,writerVectorData);
				writerTable.invalidate();
				writerTable.updateUI();
			}
		});

		//add table and text into frame
		buttonSearch.setText("search");
		buttonSearch.setBounds(100, 390, 106, 28);
		getContentPane().add(buttonSearch);

		final JScrollPane scrollPane = new JScrollPane();
		scrollPane.setBounds(50, 46, 100, 30);
		getContentPane().add(scrollPane);

		genre = new JTextArea();
		scrollPane.setViewportView(genre);

//		final JScrollPane scrollPane_1 = new JScrollPane(filmTable);
//		filmTable.setFillsViewportHeight(true);
//		scrollPane_1.setBounds(400, 30, 350, 70);
//		getContentPane().add(scrollPane_1);


		final JScrollPane scrollPane_input = new JScrollPane();
		scrollPane_input.setBounds(50, 150, 150, 30);
		getContentPane().add(scrollPane_input);
```

```
        actortext = new JTextArea();
        scrollPane_input.setViewportView(actortext);

        final JScrollPane scrollPane_output1 = new JScrollPane(actorTable);
        actorTable.setFillsViewportHeight(true);
        scrollPane_output1.setBounds(400, 115, 350, 70);
        getContentPane().add(scrollPane_output1);

//
        final JScrollPane scrollPane_output2 = new JScrollPane(directorTable);
        directorTable.setFillsViewportHeight(true);
        scrollPane_output2.setBounds(400, 205, 350, 70);
        getContentPane().add(scrollPane_output2);


        final JScrollPane scrollPane_output3 = new JScrollPane(writerTable);
        writerTable.setFillsViewportHeight(true);
        scrollPane_output3.setBounds(400, 295, 350, 70);
        getContentPane().add(scrollPane_output3);


        final JLabel label = new JLabel();
        label.setText("Input genre");
        label.setBounds(50, 22, 80, 18);
        getContentPane().add(label);

//      final JLabel label_1 = new JLabel();
//      label_1.setText("Filmlist");
//      label_1.setBounds(400, 13, 66, 18);
//      getContentPane().add(label_1);

        final JLabel labeinput = new JLabel();
        labeinput.setText("Input person name");
        labeinput.setBounds(50, 130, 150, 18);
        getContentPane().add(labeinput);

        final JLabel labeoutput1 = new JLabel();
        labeoutput1.setText("As actor");
        labeoutput1.setBounds(400, 100, 150, 10);
        getContentPane().add(labeoutput1);

        final JLabel labeoutput2 = new JLabel();
        labeoutput2.setText("As director");
        labeoutput2.setBounds(400, 190, 150, 18);
        getContentPane().add(labeoutput2);

        final JLabel labeoutput3 = new JLabel();
        labeoutput3.setText("As writer");
        labeoutput3.setBounds(400, 278, 150, 18);
```

```
            getContentPane().add(labeoutput3);
        }


        public void initTable(){
            this.filmVectorColName.addElement("Title");
            this.filmVectorColName.addElement("Year");
            this.filmVectorColName.addElement("Language");
            this.filmVectorColName.addElement("Nationality");
        }

        //add data into table
        public void setData(ArrayList list, Vector data){
            for(int i = 0; i < list.size() ; i++){
                Vector vector = new Vector();
                Movie movie = (Movie) list.get(i);
                vector.addElement(movie.getTitle());
                vector.addElement(movie.getYear());
                vector.addElement(movie.getLanguage());
                vector.addElement(movie.getNation());
                data.addElement(vector);
            }
        }

        public void clearData(){
            this.filmVectorData.clear();
            this.directorVectorData.clear();
            this.actorVectorData.clear();
            this.writerVectorData.clear();
        }


}
```

App Screenshots

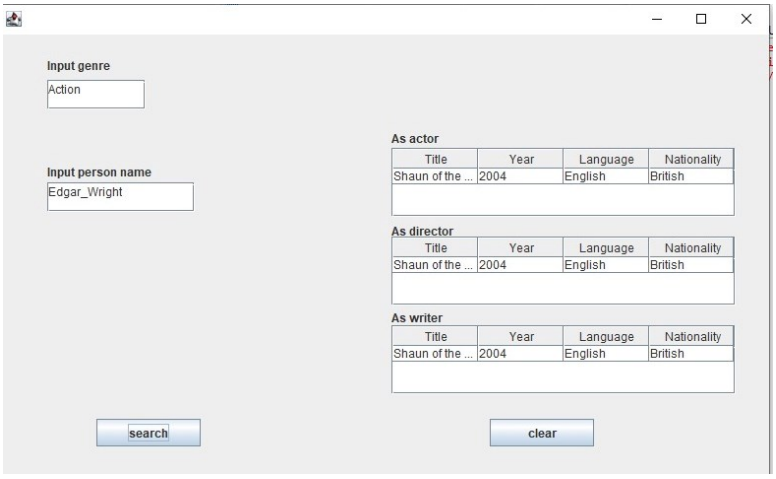


Figure 23: Edgar Write roles in all actions movies

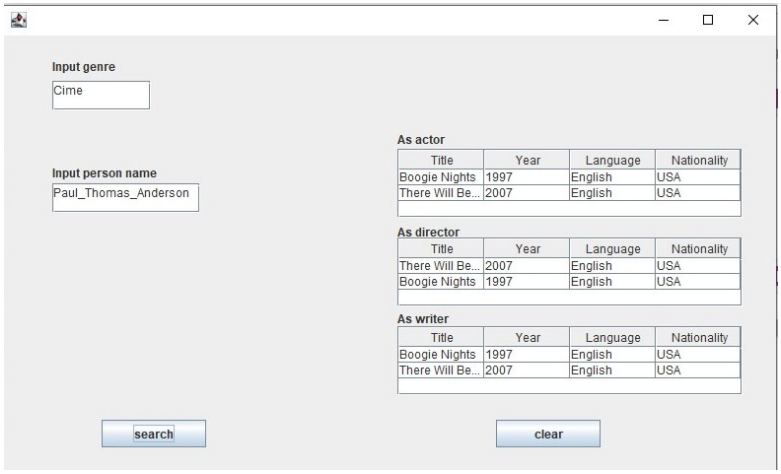


Figure 24: Paul Thomas roles in all crime movies

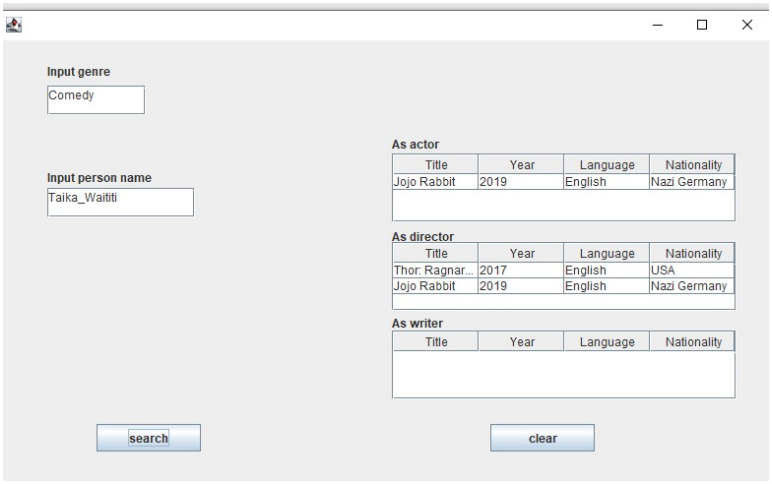


Figure 25: Taiki Waititi roles in Comedy movies

Github Link

https://github.com/amrressam148/Cinema-Ontology