

Mini-projet - Web sémantique et web des données

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Git: <https://github.com/wisdom-jiee/RDFS-Project.git>

1 Data Selection

Dataset: [GoodReads Best Books | Kaggle](#)

The experimental data comes from the Kaggle "Comprehensive overview of 52,478 GoodReads best books", which is a compilation of books from the "Best Books" list on the GoodReads website. The data is provided in structured table (CSV) format.

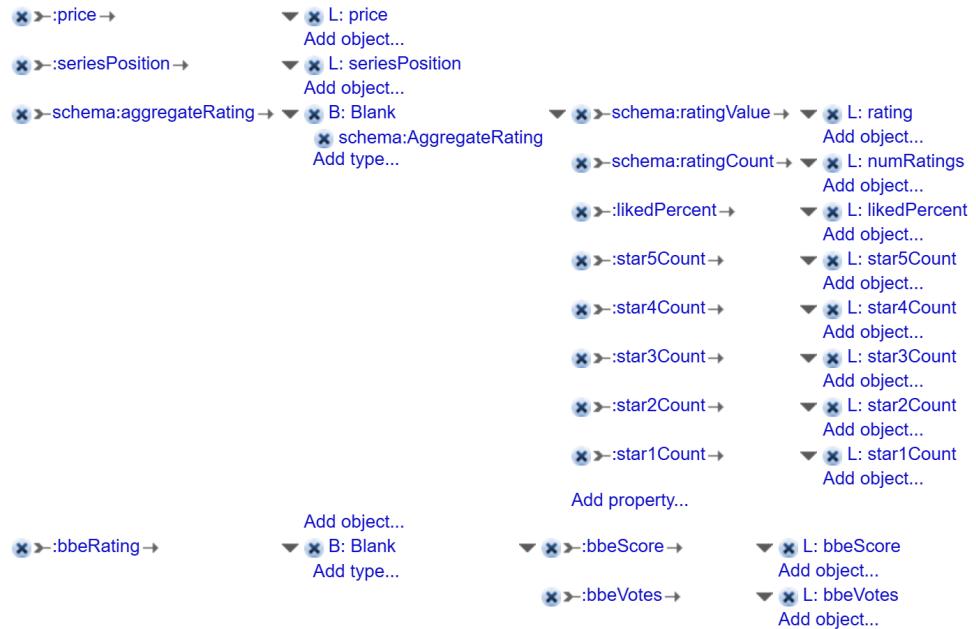
It not only contains basic metadata about books, such as title and author, but also provides statistical information from the reader community, such as average ratings, as well as content-related tags or category information.

The relationships between books and authors are "one-to-many" or "many-to-many"; there are also various types of relationships between books and genres, awards, and publishers, making it very suitable for establishing semantic relationships in this experiment.

For the sake of experimental convenience, we only retained the first 9999 data entries, which allows for rapid processing and provides a sufficient number of entity types and relationship types.

2 RDF





When designing RDF, we prioritize reusing classes and properties from schema.org. When additional information is needed, we define properties under a local namespace.

Each book is modeled as a schema:Book entity, and its URI is constructed using the bookId field from the dataset, for example: `book_11870085_the_fault_in_our_stars`

Around schema:Book, we model a set of entities connected by object properties. It contains Author, Series, Language, Genre, Character, Publisher and so on. Therefore, through OpenRefine, we can successfully construct RDF, which includes the complex relationships between attributes.

And I also use Blank Nodes on **Goodreads rating** and **bbeRating**. Each book has a schema:aggregateRating. Use it on this resource schema:ratingValue, schema:ratingCount, :likedPercent... Because this rating information is only relevant to the book and does not need to be cited separately elsewhere, we use blank nodes instead of explicit URIs, which reduces the number of URIs while keeping the information aggregated in the RDF for easy querying.

The RDF excerpt is in the appendix at the end of the article. Detailed RDF information for the data can be found in `books_data_pretty.ttl`.

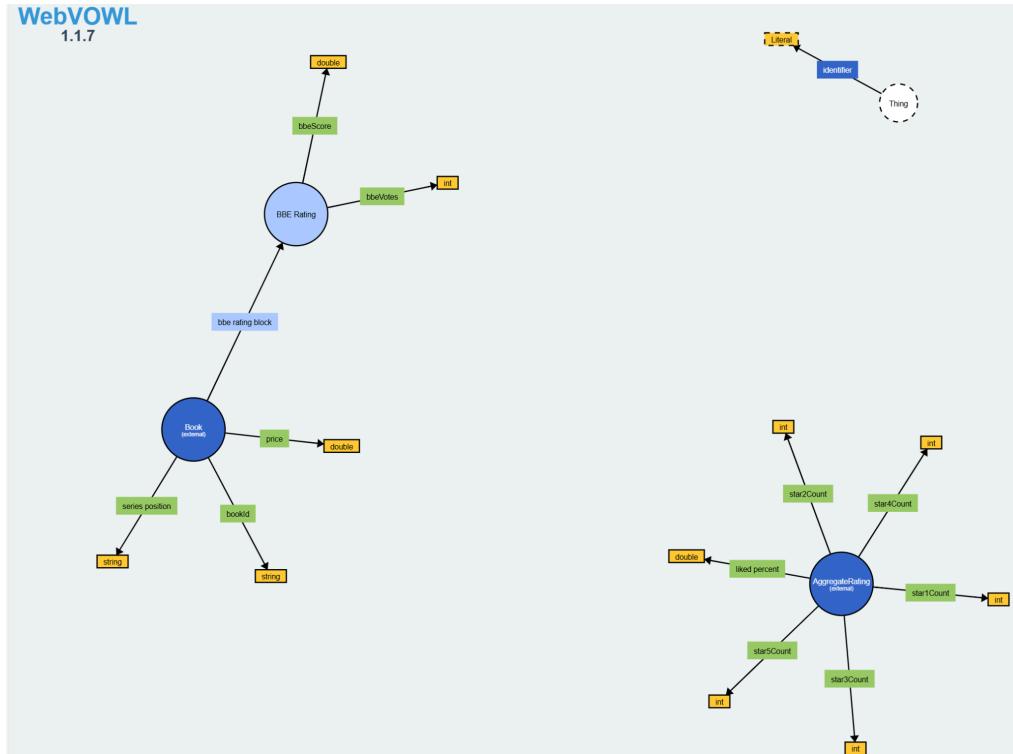
3 RDFS

We defined a minimal RDFS/OWL vocabulary to supplement the fields in the dataset with necessary semantic constraints and documentation, facilitating subsequent querying, validation, and reuse.

For the Ontology header, I use rdfs:label and rdfs:comment to provide a brief description.

And for BBERating, to avoid mixing it with schema:AggregateRating, we set up a separate class. `:BBERating` a `owl:Class` Each book points to a `:BBERating` instance via the object property `:bbeRating`.

I also set constraints for some fields, I set `rdfs:domain` and `rdfs:range` of `bookId`, `seriesPosition`, `AggregateRating` and so on. The details can be found in `books-vocab_new.ttl`. I received help from LLM while writing RDFS, but I have completely figured out the syntax and meaning.



By using WebVOWL, we can visualize RDFS and check for errors within it.

The screenshot shows the RDFShape interface for data conversion:

- Data (RDF):** Includes tabs for `Text`, `URL`, and `File`. A file input field contains `books_data_example.ttl`.
- Result:** Displays the inferred RDF output in a code editor-like interface. The output starts with prefixes and includes the following triples:

```

1 * @prefix : <http://books.com/> .
2 @prefix owl: <http://www.w3.org/2002/07/owl#> .
3 @prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
4 @prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
5 @prefix schema: <http://schema.org/> .
6 @prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
7
8 :book_16150831_in_the_afterlight
9     rdf:type schema:Book ,
10    rdfs:Resource ;
11    :bbeRating
12    rdfs:Resource , :BBERating ] ;
13    :bookId
14    "16150831_in_the_afterlight" ;

```

- Configuration:** Includes dropdowns for `Format` (Turtle), `Inference` (RDFS), and `Target data format` (Turtle). A `Convert` button is at the bottom.
- Bottom:** Includes links for `Operation information` and `Full response`, and a `Permalink` button.

And by using RDFShape, we can upload RDF data and RDFS to generate an inferred RDF.

4 Fuseki

We input the rdf and rdfs files into Fuseki, and then designed SPARQL to query the data, preparing for the subsequent web application.

I designed the following SPARQL queries:

① List of the top 50 highest-rated books

SPARQL Endpoint: /books/sparql Content Type (SELECT): JSON Content Type (GRAPH): Turtle

```
1 * PREFIX schema: <http://schema.org/>
2 * PREFIX ex: <http://books.com/>
3 * PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
4
5 * SELECT ?book ?title ?rating
6 * WHERE {
7   ?book a schema:Book ;
8     schema:name ?title ;
9     schema:aggregateRating ?ar .
10  ?ar schema:ratingValue ?rating .
11 }
12 ORDER BY DESC(?rating)
13 LIMIT 50
```

② To find out which books an author has written. We linked Author iri with the books.

SPARQL Endpoint: /books/sparql Content Type (SELECT): JSON Content Type (GRAPH): Turtle

```
1 * PREFIX schema: <http://schema.org/>
2 * PREFIX ex: <http://books.com/>
3 * PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
4
5 * SELECT ?book ?title ?author
6 * WHERE {
7   ?book a schema:Book ;
8     schema:name ?title ;
9     schema:author ?author .
10  ?author schema:name "J.K. Rowling".
11 }
12 ORDER BY ?title
```

book	title	author
1 < http://books.com/book/39330961-fantastic-beasts---...	Fantastic Beasts - The Crimes of Grindelwald: The Origin al Screenplay	< http://example.org/author/j-k-rowling >
2 < http://books.com/book/41899.Fantastic_Beasts_and_...	Fantastic Beasts and Where to Find Them	< http://example.org/author/j-k-rowling >
3 < http://books.com/book/29363501-fantastic-beasts-a...	Fantastic Beasts and Where to Find Them: The Original S creenplay	< http://example.org/author/j-k-rowling >
4 < http://books.com/book/8.Harry_Potter_Boxed_Set_Bo...	Harry Potter Boxed Set, Books 1-5 (Harry Potter, #1-5)	< http://example.org/author/j-k-rowling >
5 < http://books.com/book/10.Harry_Potter_Collection >	Harry Potter Collection	< http://example.org/author/j-k-rowling >

③ For books with series, we find their series position and list which volume the book belongs to.

```
1 * PREFIX schema: <http://schema.org/>
2 * PREFIX ex: <http://books.com/>
3 * PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
4
5 * SELECT ?title ?seriesName ?pos
6 * WHERE {
7   ?book a schema:Book ;
8     schema:name ?title ;
9     schema:isPartOfSeries ?series .
10  OPTIONAL { ?book ex:seriesPosition ?pos . }
11  OPTIONAL { ?series schema:name ?seriesName . }
12 }
13 ORDER BY ?seriesName ?pos ?title
```

6Sanctuary	1-800-Where-R-You	4
7Missing You	1-800-Where-R-You	5
8100 Cupboards	100 Cupboards	1
91Q84	1Q84	1
101Q84 #1-2	1Q84	1-2

④ Number of books by genre

```

1 * PREFIX schema: <http://schema.org/>
2
3 SELECT ?genre (COUNT(DISTINCT ?book) AS ?nBooks)
4 * WHERE {
5   ?book a schema:Book ;
6     schema:genre ?genre .
7 }
8 GROUP BY ?genre

```



genre	nBooks
1<http://example.org/genre/fiction>	*8016*^^<http://www.w3.org/2001/XMLSchema#integer>
2<http://example.org/genre/fantasy>	*4172*^^<http://www.w3.org/2001/XMLSchema#integer>
3<http://example.org/genre/romance>	*3622*^^<http://www.w3.org/2001/XMLSchema#integer>
4<http://example.org/genre/young-adult>	*3396*^^<http://www.w3.org/2001/XMLSchema#integer>
5<http://example.org/genre/novels>	*2547*^^<http://www.w3.org/2001/XMLSchema#integer>

The **schema:genre** is correctly modeled as a multivalued object attribute, and the many-to-many relationship between **genre** and **book** is correctly expressed in the RDF model.

Detailed experimental results are included in the appendix at the end.

5 Web

The screenshot shows a web application for querying a RDF dataset about books. The interface includes:

- SPARQL endpoint:** http://localhost:3030/books/sparql or https://query.wikidata.org/sparql
- Query:** A section with several buttons for common queries: "Top 50 highest-rated books", "Search books by author" (with input "Robert Graves" and "Search" button), "Books with series + seriesPosition", "Number of books by genre", and "Comparing Goodreads rating and BBE score". Below these is a field "Find the author's nationality based on the book title (Wikidata):" with input "Catching Fire" and "Search" button.
- SPARQL:** A code editor containing the following SPARQL query:

```

PREFIX schema: <http://schema.org/>
PREFIX author: <http://www.w3.org/ns/authors#>
PREFIX rating: <http://www.w3.org/ns/rating#>

SELECT ?author ?rating
WHERE {
  ?book schema:author ?author .
  ?book rating:ratingValue ?rating .
  OPTIONAL {
    ?author schema:name ?authorName .
  }
}
ORDER BY DESC(?rating)
LIMIT 50
  
```

Buttons: "Go" and "OK – 50 result(s)."
- Results:** A table showing the top 50 highest-rated books:

bookid	title	rating	authorName
378000210	Gris Anne 2014	5	Ludin Anja Christine Rosenkrautz

I've written a simple web page to display the functionality. At the beginning of the page, you can select the SPARQL endpoint, which might typically be the current database or Wikipedia.

Then there will be some buttons, corresponding to the previously designed SPARQL statements. Clicking them will display the corresponding content in the SPARQL area and result area below. It also supports writing content into the SPARQL area and executing it.

The web application is implemented as a single HTML5 page with embedded CSS for basic layout and JavaScript code for sending SPARQL queries, and rendering result tables

6 Wikidata

The screenshot shows a web-based SPARQL query interface. At the top, there is a search bar with the placeholder "Find the author's nationality based on the book title (Wikidata):" followed by a text input field containing "Catching Fire" and a "Search" button. Below this is a "SPARQL" section containing a query:

```
SELECT ?name ?author ?countryLabel
WHERE {
VALUES ?name { "Suzanne Collins" }
?author rdfs:label ?name .
?author wdt:P31 wd:Q5 . # Human
?author wdt:P106 wd:Q36180 . # writer
?author wdt:P27 ?country . # country of citizenship
SERVICE wikibase:label { bd:serviceParam wikibase:language "en". }
}
```

Below the query is a "Go" button and the text "OK – 1 result(s)." The results section shows a table with one row:

name	author	countryLabel
Suzanne Collins	http://www.wikidata.org/entity/Q228624	United States

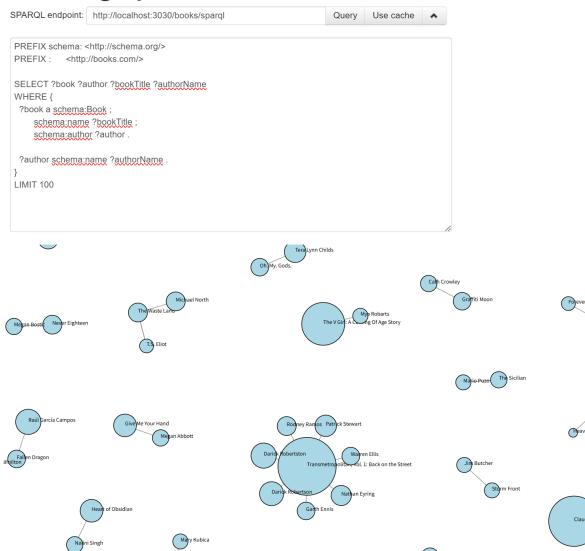
We support entering the book title on the webpage and then querying the author's nationality via Wikidata.

When we enter a book title, the system first searches for the author in our dataset, then changes the endpoint to search for the author's nationality in Wikipedia's database. To prevent finding irrelevant individuals, I also restrict the Wikipedia search to $wdt:P31\ wd:Q5\ ;\ wdt:P106\ wd:Q36180$, meaning the person must be a person and an author.

Even so, sometimes the search still returns authors with the same name, or some authors may not return results due to formatting issues.

7 Visualization

d3forcegraph



I tried using D3SPARQL to achieve visualization, but ultimately failed to successfully visualize it on my own web application.

Appendix

RDF excerpt

```

:book_32822135_archer_s_voice
  rdf:type schema:Book;
  :bbeRating [
    :bbeScore "6030"^^xsd:double;
    :bbeVotes "70"^^xsd:int
  ];
  :bookId "32822135_archer_s_voice";
  schema:aggregateRating [
    rdf:type schema:AggregateRating;
    :clikedPercent "96"^^xsd:double;
    :star1Count "997"^^xsd:int;
    :star2Count "2497"^^xsd:int;
    :star3Count "8613"^^xsd:int;
    :star4Count "22005"^^xsd:int;
    :star5Count "49202"^^xsd:int;
    schema:ratingCount "83246"^^xsd:int;
    schema:ratingValue "4.39"^^xsd:double
  ];
  schema:author :author_mia_sheridan;
  schema:bookFormat :format_ebook;
  schema:character :character_archer_hale , :character_bree_prescott;
  schema:description "When Bree Prescott arrives in the sleepy, lakeside town of Pelion, Maine, she hopes against hope that this is the place where she will finally find the peace she so desperately seeks. On her first day there, her life collides with Archer Hale, an isolated man who holds a secret agony of his own. A man no one else sees. Archer's Voice is the story of a woman chained to the memory of one horrifying night and the man whose love is the key to her freedom. It is the story of a silent man who lives with an excruciating wound and the woman who helps him find his voice. It is the story of suffering, fate, and the transformative power of love.";
  schema:genre :genre_contemporary , :genre_contemporary_romance , :genre_adult , :genre_new_adult , :genre_romance , :genre_abuse , :genre_erotica , :genre_fiction , :genre_drama ,
  :genre_disability;
  schema:image <https://i.gr-assets.com/images/S/compressed.photo.goodreads.com/books/14779634661/32822135._SY475_.jpg>;
  schema:inLanguage :language_english;
  schema:isbn "9781538727379";
  schema:name "Archer's Voice";
  schema:numberOfPages "345"^^xsd:int;
  schema:publisher :publisher_forever .

:author_peter_s_beagle
  rdf:type schema:Person;
  schema:name "Peter S. Beagle".

```

① List of the top 50 highest-rated books

SPARQL Endpoint	Content Type (SELECT)	Content Type (GRAPH)
/books/sparql	JSON	Turtle
<pre> 1 * PREFIX schema: <http://schema.org/> 2 * PREFIX ex: <http://books.org/> 3 * PREFIX xsd: <http://www.w3.org/2001/XMLSchema#> 4 5 SELECT ?book ?title ?rating 6 WHERE 7 ?book a schema:Book ; 8 schema:name ?title ; 9 schema:aggregateRating ?ar . 10 ?ar schema:ratingValue ?rating . 11 } 12 ORDER BY DESC(?rating) 13 LIMIT 50 </pre>		
book	title	rating
1<http://books.com/book/37794574-das-geheimnis-der...Das geheimnis der blumen (DEU)		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
2<http://books.com/book/14288412-abstraction-in-the... Abstraction In Theory - Laws Of Physical Transaction		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
3<http://books.com/book/17608096-obsured-darkness>Obscured Darkness (Family Secrets #2)		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
4<http://books.com/book/41009603-elliptical-door-a-m...Elliptical door (A multifaceted overview) (US) (2013)		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
5<http://books.com/book/37794574-das-geheimnis-der...Das geheimnis der blumen (DEU)		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
6<http://books.com/book/55506538-the-daughter-of-k... The Daughter Of Kurldan: A Life Dedicated to Human...		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
7<http://books.com/book/37800210-gris-ange-2014> Gris Ange 2014		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
8<http://books.com/book/55477907-females-of-valor> Females of Valor		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
9<http://books.com/book/30152013-le-poin-on-pilot-e... Le Poinçon « Pilot Edition »		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
10<http://books.com/book/55506538-the-daughter-of-k... The Daughter Of Kurldan: A Life Dedicated to Human...		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
11<http://books.com/book/17608096-obsured-darkness>Obscured Darkness (Family Secrets #2)		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
12<http://books.com/book/55477907-females-of-valor> Females of Valor		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
13<http://books.com/book/17259227-patience-s-love> Patience's Love		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
14<http://books.com/book/14288412-abstraction-in-the... Abstraction In Theory - Laws Of Physical Transaction		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
15<http://books.com/book/17259227-patience-s-love> Patience's Love		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
16<http://books.com/book/41009603-elliptical-door-a-m...Elliptical door (A multifaceted overview) (US) (2013)		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
17<http://books.com/book/30152061-rosto-inacabado-p... Rosto Inacabado (Pequenos segredos alquímicos) (PT) (...		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
18<http://books.com/book/30152013-le-poin-on-pilot-e... Le Poinçon « Pilot Edition »		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
19<http://books.com/book/30152061-rosto-inacabado-p... Rosto Inacabado (Pequenos segredos alquímicos) (PT) (...		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>
20<http://books.com/book/37800210-gris-ange-2014> Gris Ange 2014		"5.0e0"^^<http://www.w3.org/2001/XMLSchema#double>

② To find out which books an author has written.

SPARQL Endpoint: /books/sparql

Content Type (SELECT): JSON

Content Type (GRAPH): Turtle

```

1 * PREFIX schema: <http://schema.org/>
2 * PREFIX ex: <http://books.com/>
3 * PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
4
5 SELECT ?book ?title ?author
6 * WHERE {
7   ?book a schema:Book ;
8     schema:name ?title ;
9     schema:author ?author .
10  ?author schema:name "J. K. Rowling" .
11 }
12 ORDER BY ?title

```

Table Response 20 results in 0.037 seconds

Simple view □ Ellipse Filter query results Page size: 50

book	title	author
1<http://books.com/book/39330961-fantastic-beasts-and-where-to-find-them>	Fantastic Beasts - The Crimes of Grindelwald: The Original Screenplay	<http://example.org/author/j-k-rowling>
2<http://books.com/book/41899.fantastic_beasts_and_...>	Fantastic Beasts and Where to Find Them	<http://example.org/author/j-k-rowling>
3<http://books.com/book/29363501-fantastic-beasts-a...>	Fantastic Beasts and Where to Find Them: The Original Screenplay	<http://example.org/author/j-k-rowling>
4<http://books.com/book/Harry_Potter_Boxed_Set_B...>	Harry Potter Boxed Set, Books 1-5 (Harry Potter, #1-5)	<http://example.org/author/j-k-rowling>
5<http://books.com/book/10.Harry_Potter_Collection>	Harry Potter Collection	<http://example.org/author/j-k-rowling>
6<http://books.com/book/862041.Harry_Potter_Series...>	Harry Potter Series Box Set	<http://example.org/author/j-k-rowling>
7<http://books.com/book/15881.Harry_Potter_and_the_C...>	Harry Potter and the Chamber of Secrets	<http://example.org/author/j-k-rowling>
8<http://books.com/book/29056083-harry-potter-and-t...>	Harry Potter and the Cursed Child: Parts One and Two	<http://example.org/author/j-k-rowling>
9<http://books.com/book/136251.Harry_Potter_and_th...>	Harry Potter and the Deathly Hallows	<http://example.org/author/j-k-rowling>
10<http://books.com/book/6.Harry_Potter_and_the_Gob...>	Harry Potter and the Goblet of Fire	<http://example.org/author/j-k-rowling>
11<http://books.com/book/1.Harry_Potter_and_the_Half...>	Harry Potter and the Half-Blood Prince	<http://example.org/author/j-k-rowling>
12<http://books.com/book/2.Harry_Potter_and_the_Ore...>	Harry Potter and the Order of the Phoenix	<http://example.org/author/j-k-rowling>
13<http://books.com/book/1317181.Harry_Potter_and_th...>	Harry Potter and the Order of the Phoenix (Harry Potter and the Cursed Child: Parts One and Two)	<http://example.org/author/j-k-rowling>
14<http://books.com/book/5.Harry_Potter_and_the_Prison...>	Harry Potter and the Prisoner of Azkaban	<http://example.org/author/j-k-rowling>
15<http://books.com/book/3.Harry_Potter_and_the_Sorcer...>	Harry Potter and the Sorcerer's Stone	<http://example.org/author/j-k-rowling>
16<http://books.com/book/111450.Quidditch_Through_t...>	Quidditch Through the Ages	<http://example.org/author/j-k-rowling>
17<http://books.com/book/13497818-the-casual-vacanc...>	The Casual Vacancy	<http://example.org/author/j-k-rowling>
18<http://books.com/book/99298.The_Harry_Potter_Coll...>	The Harry Potter Collection 1-4	<http://example.org/author/j-k-rowling>
19<http://books.com/book/2337379.The_Harry_Potter_tr...>	The Harry Potter trilogy	<http://example.org/author/j-k-rowling>
20<http://books.com/book/3950967-the-tales-of-beedle...>	The Tales of Beedle the Bard	<http://example.org/author/j-k-rowling>

③ For books with series, find their series position and list the volume.

SPARQL Endpoint: /books/sparql

Content Type (SELECT): JSON

Content Type (GRAPH): Turtle

```

1 * PREFIX schema: <http://schema.org/>
2 * PREFIX ex: <http://books.com/>
3 * PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
4
5 SELECT ?title ?seriesName ?pos
6 * WHERE {
7   ?book a schema:Book ;
8     schema:name ?title ;
9     schema:isPartOfSeries ?series .
10  OPTIONAL { ?book ex:seriesPosition ?pos . }
11  OPTIONAL { ?series schema:name ?seriesName . }
12 }
13 ORDER BY ?seriesName ?pos ?title

```

2When Lightning Strikes	1-800-Where-R-You	1
3Vanished: When Lightning Strikes / Code Name Cassandra...	1-800-Where-R-You	1 & 2
4Code Name Cassandra	1-800-Where-R-You	2
5Safe House	1-800-Where-R-You	3
6Sanctuary	1-800-Where-R-You	4
7Missing You	1-800-Where-R-You	5
8100 Cupboards	100 Cupboards	1
91Q84	1Q84	1
101Q84 #1-2	1Q84	1-2
111Q84	1Q84	1-3
121Q84	1Q84	3
132666	2666	1-5
14300	300 Universe	1
15The Fourth Monkey	4MK Thriller	1
16The 5 Love Languages: The Secret to Love that Lasts	5 Love Languages	
17One Tuesday Morning	9/11	1
18Beyond Tuesday Morning	9/11	2
19Every Now & Then	9/11	3
20A Beautiful Dark	A Beautiful Dark	1
21A Suitable Boy	A Bridge of Leaves	1
22A Court of Thorns and Roses	A Court of Thorns and Roses	1
23A Court of Mist and Fury	A Court of Thorns and Roses	2
24A Court of Wings and Ruin	A Court of Thorns and Roses	3
25A Court of Frost and Starlight	A Court of Thorns and Roses	3.1
26A Dance to the Music of Time: 1st Movement	A Dance to the Music of Time	1-3
27A Distant Mirror: The Calamitous 14th Century	A Distant Mirror: The Calamitous 14th Century	
28A Dog's Purpose	A Dog's Purpose	1
29A Dog's Life: The Autobiography of a Stray	A Dog's Life	1
30Waking Rose	A Fairy Tale Retold	3
31From Maid to Duchess	A Fairytale Retelling	1

④ Number of books by genre

SPARQL Endpoint: /books/sparql

Content Type (SELECT): JSON

Content Type (GRAPH): Turtle

```

1 PREFIX schema: <http://schema.org/>
2 PREFIX ex:   <http://books.com/>
3 PREFIX xsd:  <http://www.w3.org/2001/XMLSchema#>
4
5 SELECT ?book ?title ?author
6 WHERE {
7   ?book a schema:Book ;
8     schema:name ?title ;
9     schema:author ?author .
10 ?author schema:name "J. K. Rowling" .
11 }
12 ORDER BY ?title
  
```

genre	nBooks
1< http://example.org/genre/fiction >	*8016**^< http://www.w3.org/2001/XMLSchema#integer >
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