Exercise 4.1. Write a SPARQL query that counts the number of directed triangles along edge edges. Which answer do you expect on the following graph?

```
_:1 edge _:1 , _:2 , _:3 , _:4 .
_:2 edge _:1 , _:3 .
_:3 edge _:1 , _:2 .
_:4 edge _:1 , _:4 .
```

Exercise 4.2. Consider the following graph.

```
eg: Arrival eg: actorRole aux1 , aux2 ;
eg: director "Denis Villeneuve" .
eg: aux1 eg: actor Adams ;
eg: character "Louise Banks" .
eg: aux2 eg: actor Renner ;
eg: character "Ian Donnelly" .
eg: Gravity eg: actorRole [ eg: actor Bullock ;
eg: character "Ryan Stone" ] ;
eg: actorRole [ eg: actor Clooney ;
eg: character "Matt Kowalski" ] ;
eg: director "Alfonso Cuarón" .
eg: AmericanHustle eg: actorRole aux3 , aux4 ;
eg: director "David Russell" .
eg: aux3 eg: actor Adams ;
eg: character "Sydney Prosser" .
eg: aux4 eg: actor Renner ;
eg: character "Carmine Polito" .
```

Write a SPARQL query that finds all pairs of actors that have co-starred in two movies. Which results do you expect?

Exercise 4.3. Inspect the Wikidata page of item Q323270 (“Saxon State and University Library”), and download its RDF-encoded data in Turtle format from https://www.wikidata.org/wiki/Special:EntityData/Q323270.ttl. Find out how the statement for the property “coordinate location” is encoded in the RDF graph, and draw the subgraph containing all triples in the representation, including all auxiliary nodes introduced for this statement (you may abbreviate URIs and labels).

**Hint:** The mapping from Wikidata statements to RDF is described in detail in the online documentation “RDF Dump Format”\(^1\) (and in this paper \(^2\))

Exercise 4.4. Using the Wikidata query service,\(^3\) find the people that have received more than one Nobel Prize.

\(^1\)https://www.mediawiki.org/wiki/Wikibase/Indexing/RDF_Dump_Format
\(^2\)https://iccl.inf.tu-dresden.de/web/Inproceedings3044
\(^3\)https://query.wikidata.org/
Exercise 4.5. Is it possible to count the number of triangles in the P47 (“shares border with”) property using the Wikidata query service? Why? Why not? Is it possible to count the number of triangles of federal states?