Exercise Sheet 10: Datalog and OWL

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Exercise 10.1. Which of the following graph patterns are expressible as (stratified) Datalog queries (all predicates mentioned are binary)? Explain your answer by either giving a Datalog query or by arguing why there is none. If there is none, can the encoding of the graph be modified to support this pattern?

1. Find nodes that are connected by an edge path of length ≥ 100
2. Find nodes that are connected by an edge path of length ≤ 100
3. Find nodes that are connected by an edge path of length $\neq 100$
4. Find nodes that are not connected by an edge path of length 100
5. In a graph with a parent predicate, find nodes with a common ancestor
6. In a graph with a parent predicate, find nodes that are cousins (of any degree)
7. Find nodes that are connected by predA but not by predB
8. Find nodes that are connected by an predA path, but not by an predB path
9. Find nodes that are connected by a path of nodes as in 7
10. Find nodes connected by an arbitrary path

* 11. Find nodes connected by an arbitrary path of even length

* 12. Check if the graph contains an even number of nodes

Exercise 10.2. (9.5)
For each of the following axioms, decide whether they are syntactic sugar in OWL and show how they can be expressed using other axioms, or give a reason why they cannot be expressed otherwise.

1. `SymmetricObjectProperty(` P `)`
2. `AsymmetricObjectProperty(` P `)`
3. `DisjointObjectProperty(` P Q `)`
4. `IrreflexiveObjectProperty(` P `)`
5. `FunctionalObjectProperty(` P `)`
6. `TransitiveObjectProperty(` P `)`

Exercise 10.3. Design an OWL ontology for modelling Datalog programs.

Exercise 10.4. Show that the standard reasoning tasks of OWL are equivalent: outline how an algorithm for any of them can be used to solve the other tasks as well.