

M2 - Exam Semantic Web

Exercise 1 (4 points)

Write the following Wikipedia paragraph about Alonzo Church in RDF triple notation and directed label graph model :

"Alonzo Church was an American mathematician and logician who made major contributions to mathematical logic and the foundations of theoretical computer science. He is best known for the lambda calculus, Church ?Turing thesis, proving the undecidability of the Entscheidungsproblem, Frege ?Church ontology, and the Church ?Rosser theorem. He also worked on philosophy of language (see e. g. Church 1970). He was the founding editor of the Journal of Symbolic Logic. Alonzo Church was born on June 14, 1903, in Washington, D.C., where his father, Samuel Robbins Church, was the judge of the Municipal Court for the District of Columbia. "

Exercise 2 (6 points)

Consider the following three RDF graphs :

G1 :

```
ex:line1 ex:connects ex:p1 .
ex:line1 ex:starts-at "Gare de lyon".
ex:connects rdfs:domain ex:Place .
```

G2:

```
_:line ex:connects _:place .
_:line ex:starts-at "Gare de lyon" .
_:place rdf:type ex:Place .
```

G3:

```
_:line1 ex:connects _:place1 .
_:line1 ex:starts-at _:place2 .
_:line2 ex:connects _:place3 .
_:line2 ex:starts-at _:place4 .
```

1. Identify which graph is lean and which graph is not lean.
2. Propose a simple interpretation which satisfy the graph G_1 .
3. Check the following simple entailments :

(a) $G_1 \models G_2$

(b) $G_2 \models G_1$

(c) $G_1 \models G_3$

(d) $G_3 \models G_2$

4. Answer to question (3) using now RDF-entailments instead of simple entailments.

Exercise 3 (10 points)

Consider the following RDF dataset which contains data about bus and metro lines in paris. A bus or metro line is composed of a list of sections (intermediary stops) :

```
@prefix pb: <http://exam.org/paris/transport/bus> .
@prefix pbs: <http://exam.org/paris/transport/bus/sections> .
@prefix pm: <http://exam.org/paris/transport/metro> .
@prefix pms: <http://exam.org/paris/transport/metro/sections> .
```

```
pb:line1      pb:type "bus";
               pb:line-number "174";
               pb:number-of-section "54" ;
               pb:departure  "Gambetta";
               pb:final-arrival "V.Hugo-Sanzillon" .
```

```
ps:section    ps:section-number "1";
               ps:bus-number "174";
               ps:departure  "Gambetta";
               ps:arrival "Boieldieu" .
```

```
ps:section    ps:section-number "2";
               ps:bus-number "174";
               ps:departure  "Boieldieu";
               ps:arrival "Gallieni" .
```

```
pm:line1      pm:type "metro";
               pm:line-number "1";
               pm:number-of-section "8" ;
               pm:departure  "Olympiades";
               pm:final-arrival "Saint-Lazare" .
```

```
pms:section    ps:section-number "1";
               ps:metro-line-number "14";
               ps:departure  "Olympiades";
               ps:arrival "Bibliotheque F. Mitterrand" .
```

...

...

Write the SPARQL queries to answer the following questions :

1. Find all bus lines that starts from the "Gambetta" stop.
2. List all the stops of the metro line "14".
3. List the bus or metro lines that stops at a place whose name include "Mitterrand".
4. Give the list of the bus lines ordered by their number of sections.
5. Give the pairs of (bus-line, metro-line) that have a stop at the same place.
6. From which places one can reach the place "Gambetta" using a bus and with no more than two stops.
7. Give all the ways to travel from "Gambetta" to "Bibliotheque F. Mitterrand" using only metro lines.
8. Give all the ways to travel from "Gambetta" to "Bibliotheque F. Mitterrand".
9. Assume that there is a SPARQ endpoint which is available at : <http://exam.org/paris/opendata/sparql>. This source contains information about bus transport, for example (see the example below) the average time in minutes between the departure and the final destination of a given line (average-time-minute) as well as the popularity of the line (e.g., pod :popularity).

```
@prefix pod: <http://exam.org/paris/opendata> .  
@prefix pb: <http://exam.org/paris/transport/bus> .
```

```
pod:user1    pb:type "bus";  
              pod:average-time-minutes "120";  
              pod:popularity "54" ;
```

- (a) What is the average time of the bus line "174" ?
- (b) Find the most popular bus line that enable to go from "Gare de Lyon" to "Place de la Bastille" without any intermediary stop.

Bonus (2 points)

Prove the following statement : *Simple entailment is NP-complete.*