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Data Models and Query Languages
## Summerterm 2013

8. Exercise Sheet: TriAL & SPARQL

Discussion: 12.07.2013

Submission Guidelines: This is a mandatory exercise sheet where you have to get **50% of the points for exercise 2** to qualify for the exam! Hand in your solutions at the beginning of the tutorial on 12.07.2013.
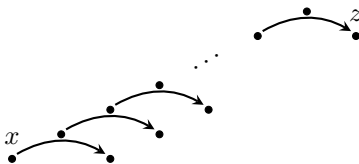
Exercise 1 (TriAL)

Formulate the reachability problems from a) and b) using SPARQL 1.1 and nSPARQL or explain why they are not expressible in that particular language:

a) $Reach_{\rightarrow}$ defined by $(E \bowtie^{1,2,3'}_{3=1'})$:
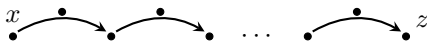
b) $Reach_{\nearrow}$ defined by $(\bowtie^{1',2',3}_{1=2'} E)$:

c) Give for $Reach_{\rightarrow}$ the equivalent TriAL definition using *left Kleene closure* and for $Reach_{\nearrow}$ the equivalent TriAL definiton using *right Kleene closure*.

Exercise 2 (Mandatory Exercise: SPARQL 1.1, 3+3+3+3+3 = 15 points)
Consider the RDF document that models a social graph in a music domain:

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix lb:   <http://example.org/lastfm/> .
lb:bob     foaf:knows      lb:user2, lb:user3, lb:user4 ;
           foaf:age        25 ;
           lb:listenedTo   lb:track1, lb:track2 ;
           lb:topArtist    lb:artist1, lb:artist2 .
lb:user2   foaf:knows      lb:user5, lb:user6 ;
           foaf:age        40 ;
           lb:listenedTo   lb:track1, lb:track2, lb:track3 ;
           lb:topArtist    lb:artist2, lb:artist4 .
lb:user3   foaf:knows      lb:user5, lb:bob, lb:user6 ;
           foaf:age        19 ;
           lb:listenedTo   lb:track2, lb:track3, lb:track4 ;
           lb:topArtist    lb:artist2, lb:artist3 .
lb:user4   lb:listenedTo   lb:track2, lb:track3, lb:track4 ;
           foaf:age        61 ;
           lb:topArtist    lb:artist3, lb:artist4, lb:artist5 .
lb:user5   foaf:knows      lb:user7 ;
           foaf:age        23 ;
           lb:topArtist    lb:artist1, lb:artist3 .
```

Formulate the following requests as SPARQL 1.1 queries. Evaluate them on the given RDF document and write down the final result.

a) Find all pairs of distinct users that have a common friend.

b) Find all users that
   - can be reached from bob by following the Friend-of-a-Friend path at most 3 times and
   - listened to at least two tracks.

c) What are the most popular tracks that users listened to at least two times? The popularity of a track corresponds to the number of times a song was listened.

d) Determine all users that know at least two other users which are older than 20. Consider only direct friendship relationships.

e) Give the minimal age out of all users that
   - can be reached from bob by following the Friend-of-a-Friend path arbitrary times and
   - refer to `artist1` as a top artist.