Homework #1: RDF

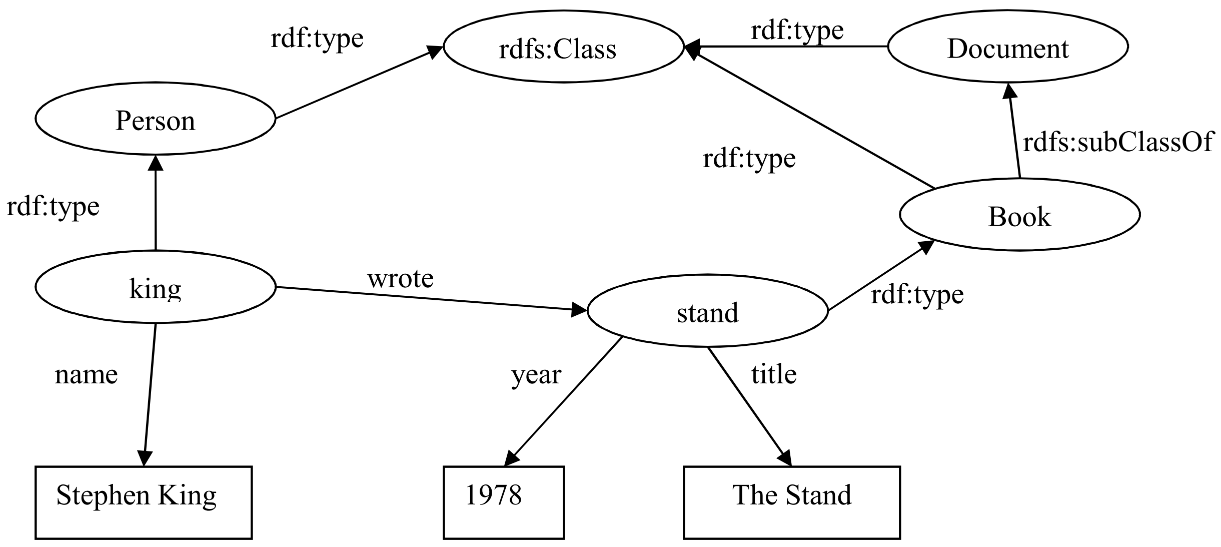
The following exercises are due at the beginning of class on Tuesday, Sep. 16. There are two sections: written exercises and electronic exercises. This will count for 10% of your overall grade.

Written Exercises:
The exercises in this section should be completed and turned in on paper.

1. *[10 pts.]* Translate the following RDF/XML Document into the Turtle syntax.

```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
         xmlns:u="http://www.example.org/uni#"
         xml:base="http://www.example.org/uni">
<rdfs:Class rdf:ID="Person" />
<rdfs:Class rdf:ID="Student">
   <rdfs:subClassOf="#Person" />
</rdfs:Class>
<rdfs:Class rdf:ID="Professor">
   <rdfs:subClassOf="#Person" />
</rdfs:Class>
<rdfs:Class rdf:ID="Course" />
<rdf:Property rdf:ID="advises">
   <rdfs:domain rdf:resource="#Professor" />
   <rdfs:range rdf:resource="#Student" />
   <rdfs:subPropertyOf="#knows">
</rdf:Property>
<rdf:Property rdf:ID="takes">
   <rdfs:domain rdf:resource="#Student" />
   <rdfs:range rdf:resource="#Course" />
</rdf:Property>
<rdf:Property rdf:ID="teaches">
   <rdfs:domain rdf:resource="#Professor" />
   <rdfs:range rdf:resource="#Course" />
</rdf:Property>
<rdf:Property rdf:ID="knows" />
<u:Professor rdf:ID="alan">
   <u:teaches rdf:resource="#cs100" />
   <u:advises rdf:resource="#rob" />
   <u:advises rdf:resource="#sarah" />
</u:Professor>
<u:Student rdf:ID="rob">
   <u:takes rdf:resource="#cs100" />
   <u:takes rdf:resource="#cs200" />
</u:Student>
</rdf:RDF>
```

2. *[10 pts.]* Translate the following RDF Graph into the RDF/XML syntax. Be careful to give the syntax that exactly translates into the provided graph. In particular, do not include syntax for any implied or inferred triples. Assume that rectangular nodes represent untyped literals. For nodes and arcs labeled with qnames, assume the standard prefixes apply. For other names, assume they are all local to the document you are writing.



3. *[10 pts.]* Using the RDFS entailment rules rdfs2, rdfs3, rdfs5, rdfs7, rdfs9, and rdfs11 (see the RDF Semantics recommendation [http://www.w3.org/TR/rdf-mt/], Section 7), determine what triples can be inferred from the example in Problem #1. You may ignore the other entailment rules because they do not add anything particularly interesting. Give you answer by listing additional triples in Turtle.

4. *[10 pts.]* Consider the following three triples (given in Turtle syntax):

   <A> rdfs:subClassOf <B> .
   <B> rdfs:subClassOf <C> .
   <C> rdfs.subClassOf <A> .

   According to the RDFS entailment rules, what additional triples can be inferred from these triples? Can you think of a situation where three triples could exhibit this pattern and not be the result of a modeiling error?

Electronic Exercises:

For these two problems, you must use Jena 2.12.0 to solve two basic tasks in RDF. I expect these to programs to total somewhere between 250 and 300 lines of code, so plan your time accordingly. Note, the Jena distribution includes a number of JAR files, and many (but not all) of these will need to be in your classpath for your programs to compile and run. You will need to import classes from the **com.hp.hpl.jena.rdf.model** package, and may find the **com.hp.hpl.jena.vocabulary.RDF** class useful as well. All of your classes should be placed in a Java package named with your Lehigh user id (e.g., aaa000), referred to as *userId.* . in the descriptions below.

5. *[25 pts.]* Consider the file **top20albums.txt** that is available on the course web page. This file includes a list of albums, one per line. Each line has the form:
   rank *artist* *album* *year*
   where fields are separated by tabs. Decide on an approach of representing this data as an RDF graph, choosing URIs for classes and properties as appropriate. You may create new URIs or reuse ones defined by existing schemas; you do not need to create an explicit RDF schema. Choose a scheme for generating a unique URI for each album. Then use Jena to write a class *userId*.**AlbumsToRdf** that can read in any file of the same form, and write out an equivalent RDF/XML file.

   From the command-line, your program should run as:

   ```
   java userId.AlbumsToRdf input output
   ```

   where *input* is the name of the text file to read from and *output* is the name of the resulting RDF file. File names will be specified as paths relative to the JVM's working directory.

6. *[35 pts.]* Using Jena, write a class *userId*.**ReadPubRdf** that can read in an RDF file describing a set of publications, and then output a condensed list of these publications to the screen, one per line. The input file will use the vocabulary from the RDF Schema **swpub.rdf,** which is available on the course web page. From the command-line, your program should run as:

   ```
   java userId.ReadPubRdf rdf-filename
   ```

   where *rdf-filename* is a relative path to the input RDF. Each entry in the output should be of the form:

   pub-type: **"***title***" by** *author*$_1$**,** *author*$_2$**, ... and** *author*$_n$ **(***year***)**

   where each italicized symbol represents information from a triple. The *pub-type* placeholder should be one of: **Article In Periodical, In Proceedings, Book Chapter,** or **Tech Report.** You can ignore any resources that are not instances of one of the corresponding classes. I have provided the file **reasoning.rdf** to help you test your program. If we ignore the linebreaks below, the output line corresponding to the first publication in this file might look like:

   ```
   In Proceedings: " SAOR: Template Rule Optimisations for
   Distributed Reasoning over 1 Billion Linked Data Triples" by
   Aidan Hogan, Jeff Z. Pan, Axel Polleres, and Stefan Decker (2010)
   ```

   Note, the input files will use the <rdf:Seq> and <rdf:li> elements to provide ordered lists of authors. Your code must appropriately navigate the resulting Jena model constructs.

   On the course website, I provide a file **SwPub.java** that includes useful constants for the various classes, properties and other resources, defined in **swpub.rdf**.

   The program should terminate successfully for any syntactically correct RDF/XML file. You should ignore any triples that do not match the expected vocabulary, and you should ignore any publications that are missing the required **rdf:type**, **title**, **authorList** or **publishedYear** triples or that have authors that are missing **fullName** triples.

Submission:

These exercises require both submission of files and hardcopies of these files. The specified files should be included as attachments to a single e-mail sent to **heflin@cse.lehigh.edu** with subject line "CSE 428 – Homework #1 Submission".

Create a zip file *userId*-prog.zip that contains your source code (.java) files, organized according to Java's file structure (i.e., classes in packages are in subdirectories corresponding to the package naming structure. Do not include any .class or Jena files in your submission, and do not put the code in a "src" directory. The contents of your zip file should be something like:

/*userId*/AlbumsToRdf.java
/*userId*/ReadPubRdf.java
…

Note, I will unzip your file directly into the working directory I will use. I will then run the commands as described for each exercise above. Thus it is important the your submission be organized exactly as I have described.

Attach the zip file to the e-mail mentioned above. Print out your .java file(s) and turn in the hardcopy with the rest of your written answers.

Grading:

Your programs will be graded on functionality (90%) and style (10%). Style includes modularity (avoid repeated code when possible, keep methods under ~60 lines, use multiple classes when appropriate), commenting (all of your files should be reasonably commented, including an initial comment that identifies you as the author and descriptive comments for each class and method), proper indentation, clear names, and use of standard naming conventions.

If I cannot immediately compile your program or run it using the procedure above, it will be returned to you to fix, and then a late penalty will be assessed depending on how long it takes you to fix it.