*The deadline for submitting your solution is on **17.01.2018**. Please do not wait until the deadline, and start preparing your solutions as early as possible! You can get up to **20 points** for this project. We will check your submission during one of the mandatory solution discussion timeslots, where you need to be able to give a short presentation of your solution and answer some associated questions. Make sure that you have thought about the questions posed in Section 6 before attending the project discussion. Detailed information on how to submit your project is given in Section 7. For questions on the assignment please come during the the office hours or send an email (see the course website for details).*

1 The Sport Team Knowledge Base

The objective of this project is to construct a Description Logic Knowledge Base (KB) about terminological knowledge on sport teams in the *Web Ontology Language* (OWL) and to implement it using the OWL editor of `Protégé 4.3`.
Before you start designing your sport team ontology we recommend reading the following tutorials to make yourself familiar with `Protégé 4.3` and ontology engineering.

- `http://protegewiki.stanford.edu/wiki/Protege4GettingStarted`
- `http://protegewiki.stanford.edu/wiki/Protege4Pizzas10Minutes`
- More detailed information on `Protégé` can be found at `http://cgi.csc.liv.ac.uk/~frank/teaching/comp08/protege_tutorial.pdf`
- A ontology development tutorial is at `http://protege.stanford.edu/publications/ontology_development/ontology101.html`
- In addition to these online-resources chapter 8 of *'Ontology Engineering'* from *'P. Hitzler, M. Krötzsch, and S. Rudolph. Foundations of Semantic Web Technologies. Chapman & Hall/CRC, 2010'*, is available for download on the course website.

Next we specify each task for this project.

2 Installation

- Download the appropriate version of `Protégé 4.3` and install the program on your computer.[1] Do **not** use any other versions of Protégé.
- NOTE: We only support `RDF/XML` ontologies. Do not save your project in another format. See the next section for details.

3 Ontology ID and Format

Now create a new ontology by clicking `File -> New`. Immediately save the new ontology as

`teams_XXXXXXX.owl` ,

where XXXXXXX is your student id. Specifically, click `File` and `Save as`. Select `RDF/XML` as the format.

[1] `http://protege.stanford.edu/download/protege/4.3/installanywhere/Web_Installers/`

In the initially selected tab `Active Ontology` the ontology's IRI can be configured. Set the following value as ontology IRI

`http://www.mpi-inf.mpg.de/ontologies/2017WS/teams_XXXXXXX.owl` ,

where XXXXXXX is your matriculation number.
Stick strictly to the naming conventions and make sure that you follow the instructions to set the correct preferences in `Protégé 4.3` according to the screenshots at the end of this project specification.

4 Specification of the TBox and RBox

In the following, a **property** is a statement of **inclusion** between concepts and a **definition** is a statement of **equivalence** between concepts.

Use the following concept names for constructing your KB:

- `Team`, `DebutTeam`, `ChampionshipTour`, `Tournament`, `SportGame`
- `BasketballTeam`, `RugbyTeam`, `FootballTeam`, `VolleyballTeam`, `MultisportTeam`
- `InterestingTournament`, `SmallSportEvent`
- `Person`, `Trainer`, `Sportsman`, `TeamMember`, `StrongAthlete`, `Foolballer`, `Master`
- `TeamSport`, `PopularSport`

The KB makes use of the following roles:

- `has` is transitive and its inverse is `belongs-to`.
- `has-winner` is a *functional role*, i.e., a tournament cannot have two different winners. Its inverse role is `is-winner-of`.
- `ogranized-by`, and its inverse is `organizes`.
- `plays`, and its inverse is `is-played-by`.
- `includes`, its inverse is `is-played-at`.
- `plays-for`.
- `takes-part-in`.
- `participates-in`
- `responsible-for`.

Translate the following statements into OWL (using the proposed concept and property names) and implement it using `Protégé 4.3`.

1. (property) A team takes part in at least one championship tour.

2. (property) A championship tour is organized by some team, and has at least one tournament.
3. (property) A tournament belongs to some championship tour.
4. (definition) A sportsman is someone who plays some sport game.
5. (definition) A team member is a sportsman who plays for some team.
6. (definition) A strong athlete is a sportsman who is a team member *or* plays at least three sport games.
7. (definition) A footballer is someone who plays for a football team.
8. (definition) A trainer is someone who trains (responsible for) some team.
9. (definition) A master is someone who is both a sportsman and a trainer.
10. (property) A sport game is played at some tournament (use `is-played-at`).
11. (definition) A team sport is a sport game, which has at least one winner.
12. (definition) A popular sport game is a sport game that is played at at least two tournaments.
13. (definition) A multisport team is a team that plays at least two of the known sport games (basketball + football, basketball + rugby, basketball + volleyball, football + rugby, football + volleyball or rugby + volleyball).
14. (definition) A tournament is interesting, if its winner is a debut team.
15. (definition) A small sport event is a tournament which includes no more than two sport games (use `includes`).

5 Specification of the ABox

Specify the following ABox assertions and individuals and add them to your KB.

1. `BV` is a basketball/volleyball team that participates in the two championship tours `BVOct` and `BVNov`, with the tournaments: `BVOct1` and `BVOct2`, and `BVNov1`, respectively.
2. Tournament `BVOct1` is won by the `BV` team (declare this only using the role membership assertion).
3. `B` is a basketball team that participates in a single championship tour `BOct` with tournaments `BOct1` and `BOct2`.
4. Tournament `BOct1` is won by the team `B`, which is a debut team (declare this only using role membership assertions).
5. `FR` is a football/rugby team that takes part in a single championship tour `FROct` with the single tournament `FROct1`.
6. Sportsman `Bob` plays `SportGame1`, which is played at tournaments `BVOct1`, `BVOct2` and `BVNov1`.

7. Sportsman `Kate` plays `SportGame2`, which is played at tournaments `BVOct2` and `BVNov1`. The same sportsman also plays `SportGame3`, which is played at tournament `FROct1`, and sport game `SportGame4`, which is played at tournament `BOct2`.
8. Sportsman `Tim` plays `SportGame5`, which is played at tournaments `BOct1` and `BOct2`. Sportsman `Tim` also plays `SportGame6`, which is played at tournament `FROct1`.
9. Person `Mary` is responsible for team `BV`.
10. Sportsman `Kate` is responsible for team `FR`.

Now select `FaCT++` as reasoner and execute `Reasoner/Start reasoner`.

6 Conclusions

Answer the following questions:

- Are the conclusions that are drawn by the reasoner according to your own manually derived conclusions? If not, what could be an explanation?
- Is the KB consistent?
- For the next step you should save a copy of your ontology to a temporary file (do not delete it).
- Select `Edit/Make all individuals distinct...` and start the reasoner again. What happens? Is your KB still consistent?
- What are the results now? Are the conclusions that are drawn by the reasoner now equal to your own conclusions?
- How does the inferred hierarchy differ from the one you explicitly set up?
- Are there any small sport events? If not, what could be an explanation?

It is not necessary to write a documentation to answer this questions, but it is possible that you have to provide an answer during your project discussion timeslot.
IMPORTANT: Submit the latest version of your KB where **all individuals are set to be distinct** but make sure that the KB is consistent!

7 Submission

Deadline for the submission of this exercise is **17.01.2017**. Upload your file

`teams_XXXXXXX.owl`,

where XXXXXXX is your matriculation number by email to gadelrab@mpi-inf.mpg.de. Submissions after the deadline will not be accepted and will result in no points.
Make sure to stick strictly to the naming conventions (i.e., the concept, property and individual names as proposed, e.g., `Team`, `BV`, `Bob`). Your submitted file has to be stored in the `RDF/XML` format and the `Protégé 4.3` preferences have to be set according to the screenshots in section 9.

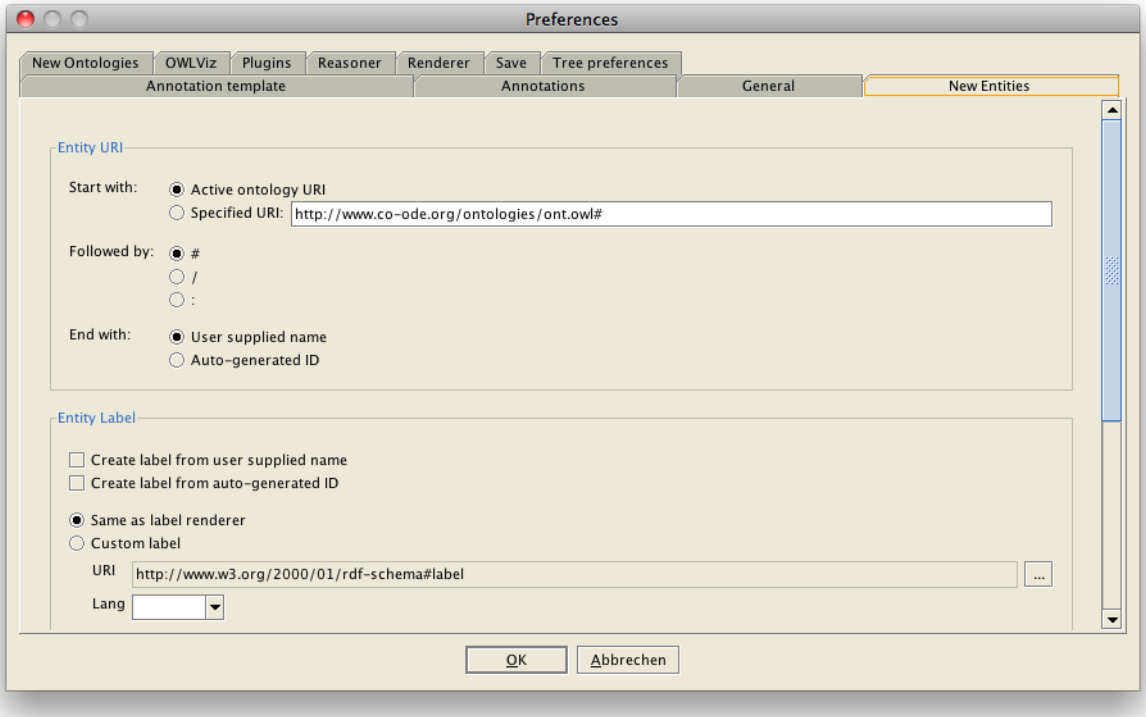
Once you have uploaded your solution, please register for one of the project discussion timeslots. The details on how to register will be available on the course website from **12.12.2017** onwards. You will be required to give a short presentation of your solution and answer some associated questions. Make sure that you have thought about the questions posed in section 6 before attending the project discussion.

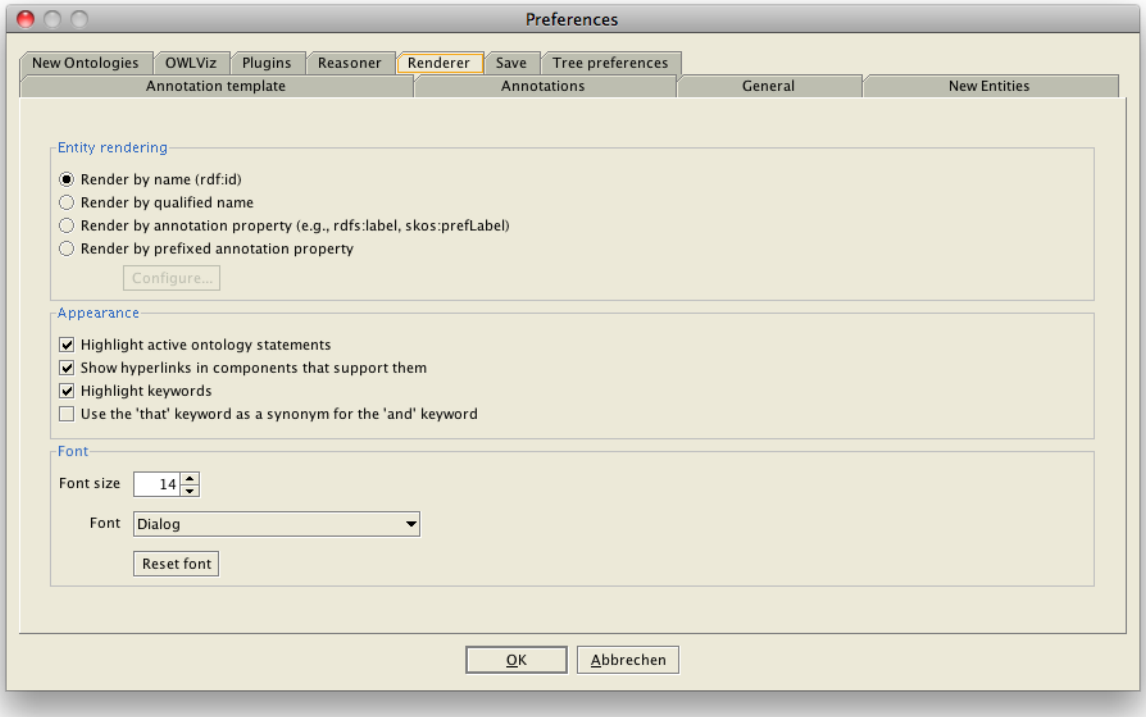
8 Questions about the assignment

You can prepare solutions in teams of at most 3 people. However, make sure that are capable of performing the whole modeling process from scratch on your own, and can answer all the questions given in the project specification.
In case questions occur, please visit our office ours (available on the website) or write an email to gadelrab@mpi-inf.mpg.de with clearly formulated questions.

9 Screenshots of the preferences

Please make sure that you have chosen the same properties as shown below within the `Protégé 4.3` preferences.




Preferences
New Ontologies
OWLViz
Plugins
Reasoner
Renderer
Save
Tree preferences
Annotation template
Annotations
General
New Entities
Entity rendering
Render by name (rdf:id)
Render by qualified name
Render by annotation property (e.g., rdfs:label, skos:prefLabel)
Render by prefixed annotation property
Configure...
Appearance
Highlight active ontology statements
Show hyperlinks in components that support them
Highlight keywords
Use the 'that' keyword as a synonym for the 'and' keyword
Font
Font size
14
Font
Dialog
Reset font
OK
Abbrechen