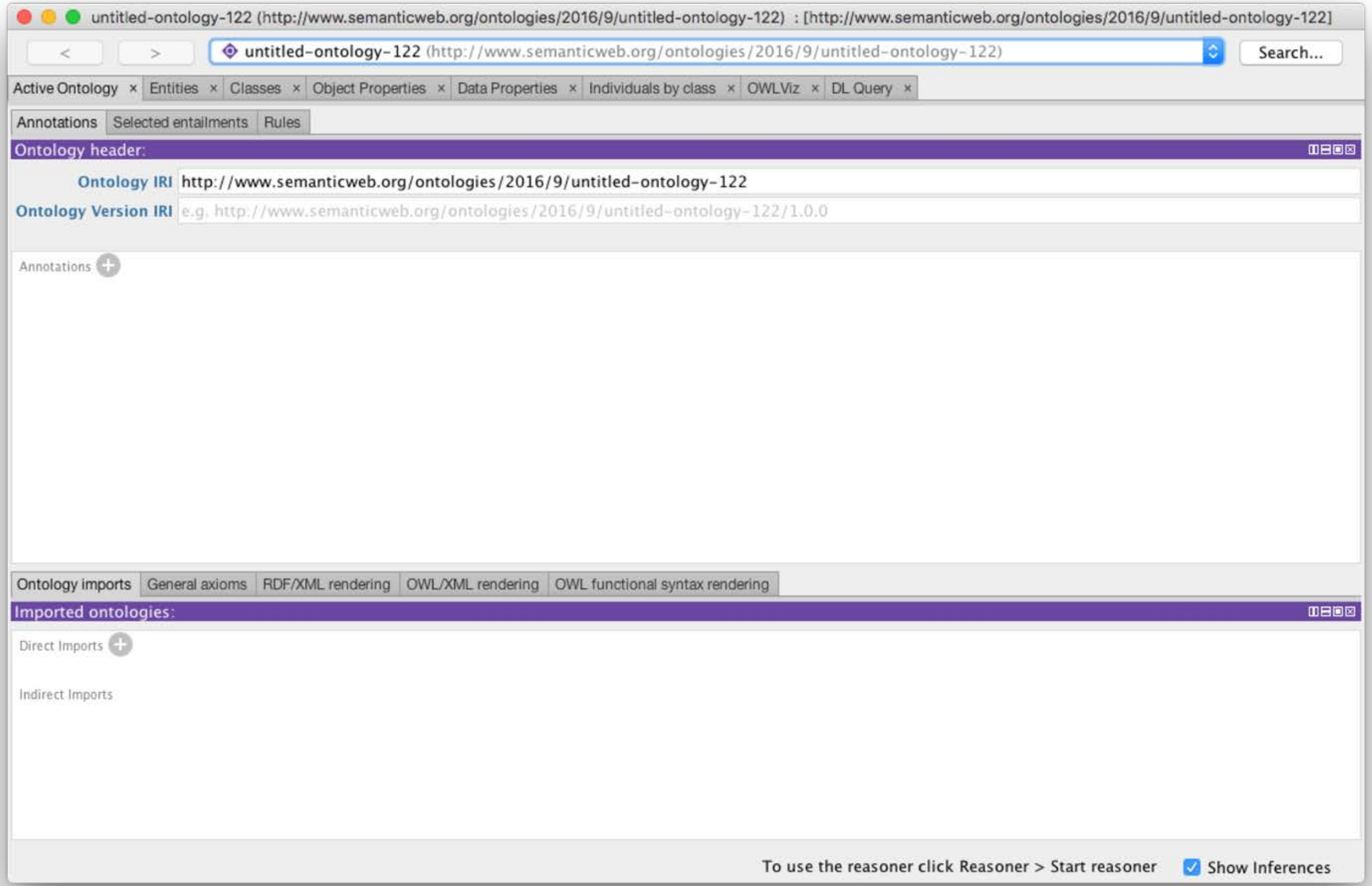
Ontology Editors

IDEs for Ontologies

- Some people use simple text editors
  - Working with XML serialization will drive you crazy
  - Using Turtle or an abstract syntax works well
- Others prefer an IDE
  - Good IDEs include support for reasoning, visualization, and more
- Protégé is a very popular IDE
  - From Stanford, free, lots of plugins
- TopQuadrant Composer is also good
  - Feature rich but expensive ($600 for a single license)

Protégé 5.1



untitled-ontology-122 (http://www.semanticweb.org/ontologies/2016/9/untitled-ontology-122) : [http://www.semanticweb.org/ontologies/2016/9/untitled-ontology-122]

untitled-ontology-122 (http://www.semanticweb.org/ontologies/2016/9/untitled-ontology-122)

Ontology header:

Ontology IRI http://www.semanticweb.org/ontologies/2016/9/untitled-ontology-122

Ontology Version IRI e.g. http://www.semanticweb.org/ontologies/2016/9/untitled-ontology-122/1.0.0

Annotations

Imported ontologies:

Direct Imports

Indirect Imports

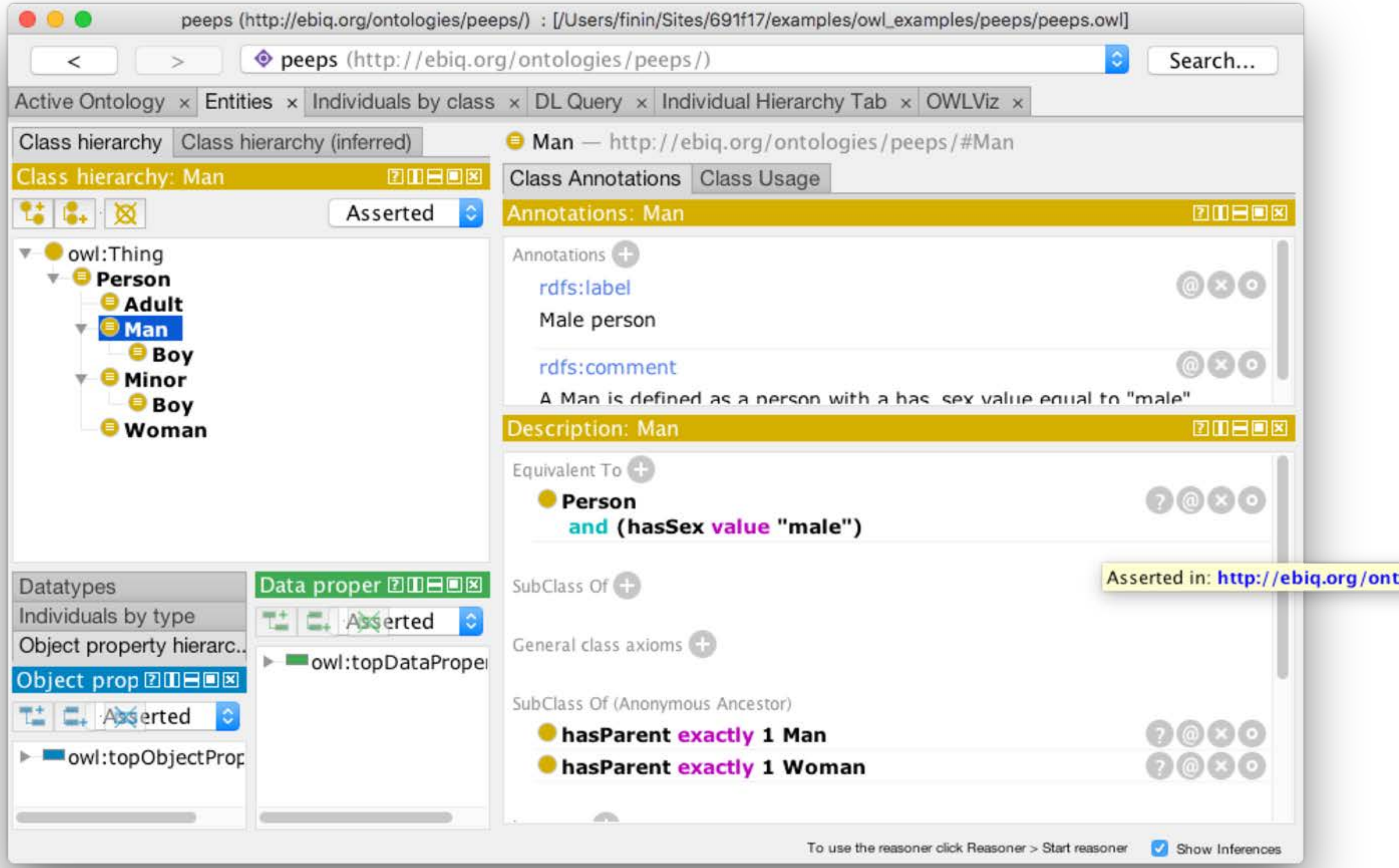
To use the reasoner click Reasoner > Start reasoner

[✓] Show Inferences

Protégé 5.2

- http://protege.stanford.edu/
- Free, open source ontology editor and KB framework
- Predates OWL, still supports earlier Frames representation
- In Java, extensible, large community of users
- Desktop and Web versions
  - Works will under Linux, Mac OS X and Windows

Desktop Protégé



peeps (http://ebiq.org/ontologies/peeps/) : [/Users/finin/Sites/691f17/examples/owl_examples/peeps/peeps.owl]

peeps (http://ebiq.org/ontologies/peeps/)

Class hierarchy: Man — Asserted

```
▼ owl:Thing
  ▼ Person
      Adult
    ▼ Man
        Boy
    ▼ Minor
        Boy
      Woman
```

Man — http://ebiq.org/ontologies/peeps/#Man

Annotations: Man

- rdfs:label: Male person
- rdfs:comment: A Man is defined as a person with a has_sex value equal to "male"

Description: Man

Equivalent To:
Person and (hasSex value "male")

SubClass Of

General class axioms

SubClass Of (Anonymous Ancestor):
- hasParent exactly 1 Man
- hasParent exactly 1 Woman

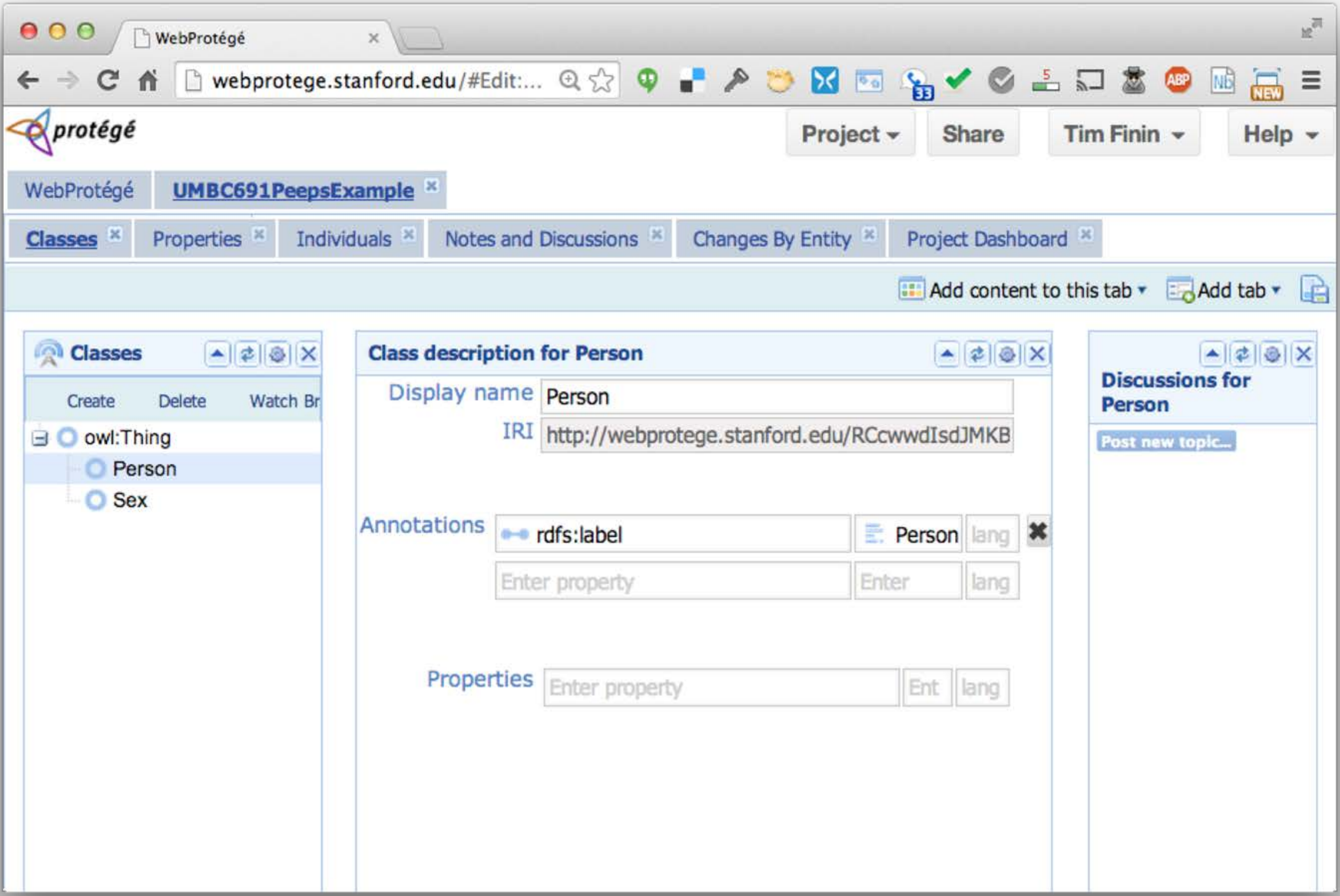
Asserted in: http://ebiq.org/ont

Object property hierarchy: owl:topObjectProp

Data property hierarchy: owl:topDataProper

To use the reasoner click Reasoner > Start reasoner

Web Protégé



Display name: Person

IRI: http://webprotege.stanford.edu/RCcwwdIsdJMKB

Annotations: rdfs:label Person lang

Enter property | Enter | lang

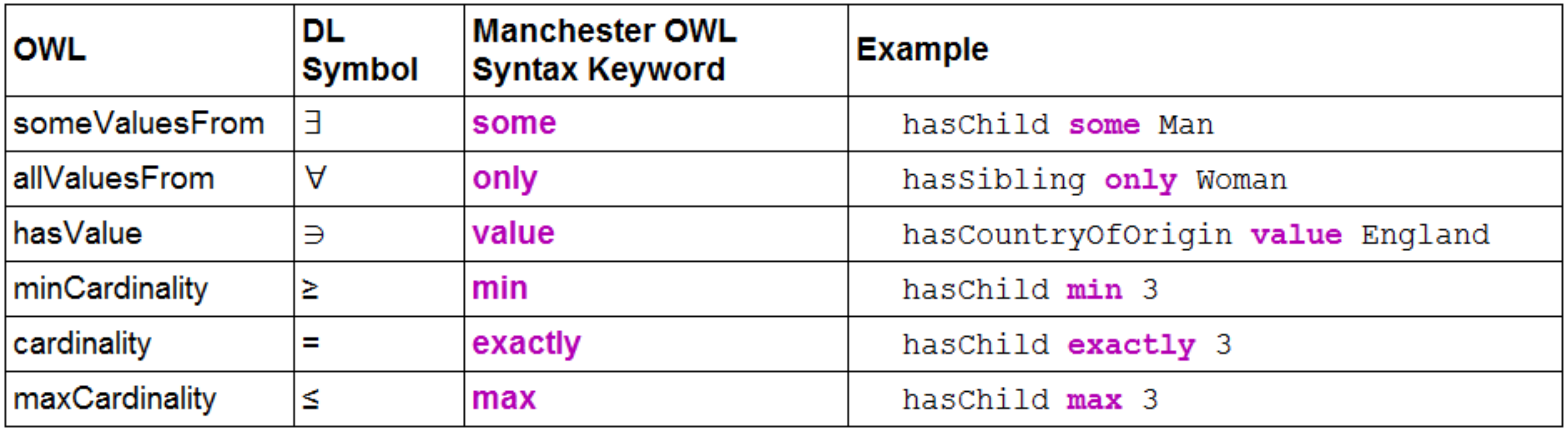
Properties: Enter property | Ent | lang

YAS: Yet Another Syntax

- Neither OWL's official abstract syntax nor XML serialization is easy to read or use
- Protégé uses the Manchester syntax
- Simpler and more compact: “some” and “only”, not “someValuesFrom” and “allValuesFrom”
- A W3C recommendation (http://bit.ly/manSyn), used in the OWL 2 Primer (http://bit.ly/OWL2Pri)

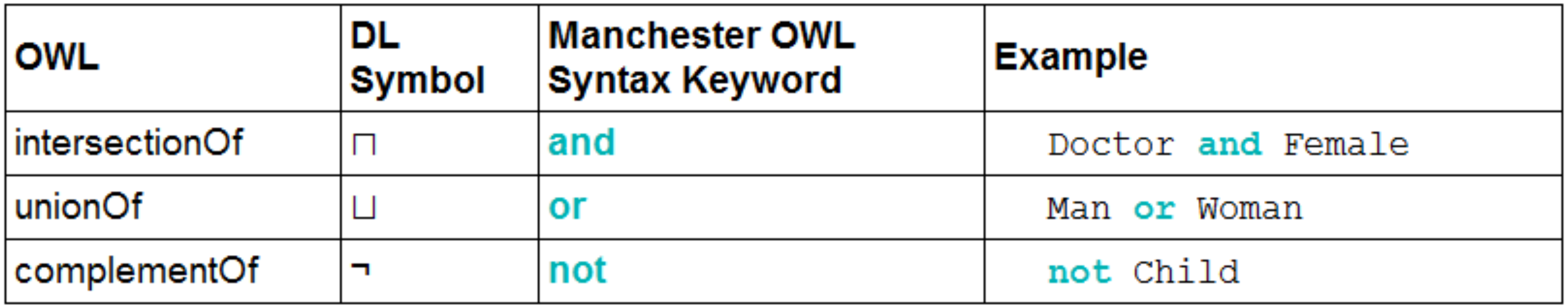
```
Class: man
   Annotations: rdfs:label "man"
   EquivalentTo: adult and male and person
```

Manchester OWL syntax



OWL	DL Symbol	Manchester OWL Syntax Keyword	Example
someValuesFrom	∃	**some**	`hasChild some Man`
allValuesFrom	∀	**only**	`hasSibling only Woman`
hasValue	∋	**value**	`hasCountryOfOrigin value England`
minCardinality	≥	**min**	`hasChild min 3`
cardinality	=	**exactly**	`hasChild exactly 3`
maxCardinality	≤	**max**	`hasChild max 3`

Manchester OWL syntax



OWL	DL Symbol	Manchester OWL Syntax Keyword	Example
intersectionOf	$\sqcap$	and	`Doctor and Female`
unionOf	$\sqcup$	or	`Man or Woman`
complementOf	$\neg$	not	`not Child`

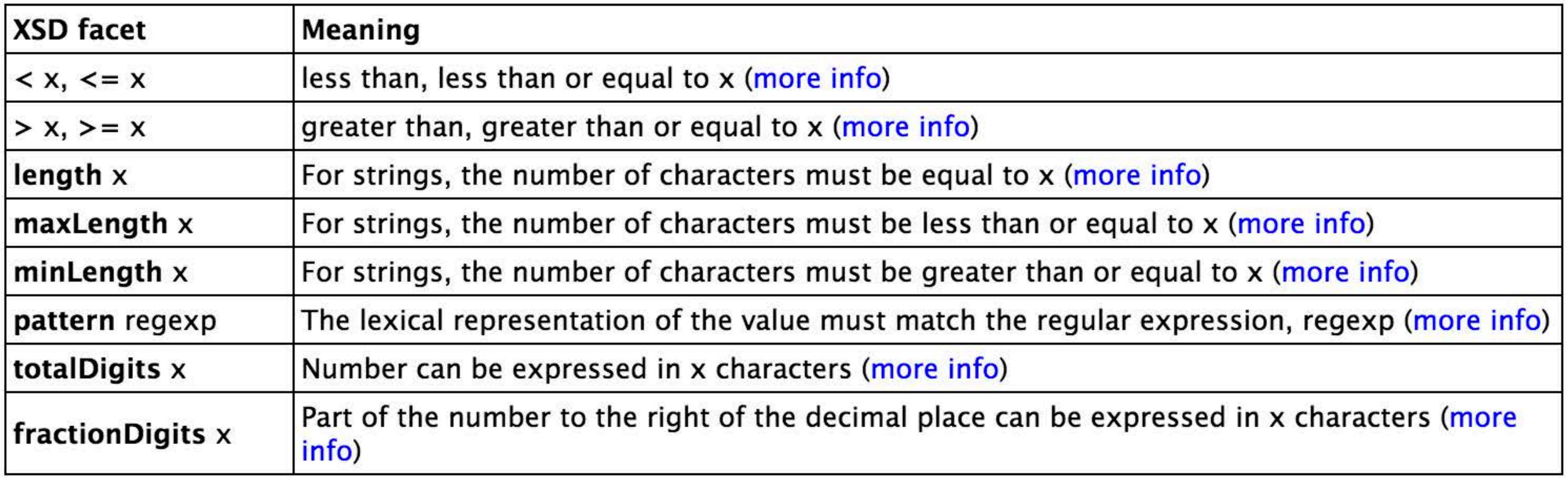
Example

```
Person and
   hasChild some
      (Person and
          (hasChild only Man) and
             (hasChild some Person))
```

The set of people who have at least one child that has some children that are only men (i.e., grandparents that only have grandsons)

Data values and datatypes

- Data values typed or untyped (e.g., int, boolean, float)
- Constants with or w/o type, e.g.: hasAge value "21"^^long
- Use datatype names as classes: hasAge some int
- XSD facets, e.g.: Person and hasAge some int[>= 65]



XSD facet	**Meaning**
< x, <= x	less than, less than or equal to x (more info)
> x, >= x	greater than, greater than or equal to x (more info)
length x	For strings, the number of characters must be equal to x (more info)
maxLength x	For strings, the number of characters must be less than or equal to x (more info)
minLength x	For strings, the number of characters must be greater than or equal to x (more info)
pattern regexp	The lexical representation of the value must match the regular expression, regexp (more info)
totalDigits x	Number can be expressed in x characters (more info)
fractionDigits x	Part of the number to the right of the decimal place can be expressed in x characters (more info)

Demonstration

- We’ll use Protégé OWL v5.2 to implement a tiny ontology for people
- Start by downloading and installing Protégé 5.2(You will need Java)
- You may want to install Graphviz
- Configure Protégé
  - E.g., select a reasoner to use (e.g., HermiT)

A basic workflow

- Think about usecases
- Preliminaries
  - Choose namespace URL, import other ontologies used
- Identify and define classes
  - Place in hierarchy, add **axioms** and run reasoner to check for errors or omissions
- Identify and define properties
  - Place in hierarchy, add **axioms**, run reasoner
- Add individuals & reasoner to check for problems
- Add comments and labels
- Export in desired formats, maybe upload to Web

More workflow steps

- Use OOPS to find common ontology pitfalls
- Link concepts (and individuals) to common ontologies (e.g., DBpedia, Freebase, foaf)
  - Use owl:sameAs
- Generate visualizations
- Produce documentation
- Develop examples with your use case(s)
- Encode data, describe in VoID (Vocabulary of Interlinked Datasets), add to LOD cloud

Demonstration

Use Protégé OWL (v5.2) to build a simple ontology for people based on the following

- People have just one sex that's either *male* or *female*, an integer age, and two parents, one male, one female
- A person's grandparent is the parent of their parent
- Every person is either a man or a woman but not both
- A man is defined as any person whose sex is male and a woman as any person whose sex is female
- A boy is defined as a person whose sex is male and whose age is less than 18, a girl is …
- A person is either an adult or (age >18), minor (age <18), …

Test cases

AllDifferent people

Alice F

Bob M

Carol F

Don M

Edith F

Pat ?

Other people

Frank M

Gwen F

Some possible test cases

- Alice parent Bob . Bob parent Carol
  - Alice grandparent Carol
- Alice parent Bob . Alice parent Don.
  - Contradiction
- Alice parent Bob . Pat parent Bob
  - Pat a female
- Alice parent Bob . Gwen parent Bob .
  - Alice owl:sameAs Gwen