Semantic Web

Tutorial 1-2

Iryna Dubrovska

WeST
People and Knowledge Networks

Tutorial 1

Task 1.True of False

1. The Semantic Web replaces the traditional HTML-based Web.

Answer: False.

Semantic Web does not replace traditional HTML web. It extends HTML web providing means to describe meaning of web content in a way that computers can interpret.

2. HTML does not separate between layout and content

Answer: True.

Task 1.True of False

3. XML tags make the semantics of the information explicit.

Answer: True.

4. “Apple" in the context of a company name and "apple" in the context of fruit, have the same semantics but different syntax.

Answer: False.
The other way around. The same syntax but different semantics.

Task 1.True of False

5. All URIs are also URL.

Answer: False.
It is the opposite, URL are special case of URIs.

6. XML tags are enough to make the semantics of the information explicit.

Answer: False.
That is why we need such things as RDF.
XML is a serialisation format and is concerned with how to encode information so that it can be parsed when being passed between machines.
RDF is responsible for informational content

Task 2. Exploring DBPedia

What is the relationship between the resource **dbpedia:Bundesautobahn 10** and **dbpedia:Thermal radiation**? Go to DBpedia and look up the URI of Bundesautobahn 10 (https://dbpedia.org/page/Bundesautobahn_10). Browse the data available and navigate through it until you reach the resource "Thermal radiation". Write down in the table below all the URIs that a software program needs to access to go from "Berlin" to "Thermal radiation".

Source URI	Property URI	Target URI
https://dbpedia.org/page/Bundesautobahn_10	is dbo:beltwayCity (https://dbpedia.org/ontology/beltwayCity)	https://dbpedia.org/page/Berlin
https://dbpedia.org/page/Berlin	is dbo:birthPlace (https://dbpedia.org/ontology/birthPlace)	https://dbpedia.org/page/Hermann_Knoblauch
https://dbpedia.org/page/Hermann_Knoblauch	is dbo:knownFor (https://dbpedia.org/ontology/knownFor)	https://dbpedia. org/page/Thermal_radiation

Task 3. Programming Task

Implement a simple HTTP client in Python that performs HTTP GET on a given URI. You can use requests library for this task. Your client should try to access a web resource that is given as an argument, print out the status code and the content retrieved as the response. Use your program to perform HTTP GET against the following resources and fill in the status codes:

https://dbpedia.org/resource/Hermann_Knoblauch Status code: **200**
https://dbpedia.org/person/Hermann_Knoblauch Status code: **400/404**

```
import requests
```

```
def request_url(url):
    response = requests.get(url)
    print('status code:', response.status_code)
    print('Content: ', response.content)
```

```
url = 'http://dbpedia.org/person/Ada_Lovelace'
request_url(url)
```

```
status code: 404
Content:  b'<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML//EN">\n<html>\n  <head>\n    <title>Error HTTP/1.1 404 File not
found</title>\n  </head>\n  <body>\n    <h3>Error HTTP/1.1 404 File not found</h3><pre>\nThe requested URL was not fo
und    URI  = \'/person/Ada_Lovelace\'\n  </pre></body></html>\n'
```

Tutorial 2

Task 1. Modelling T-Box and A-Box

Assume there is an ALC knowledge base with the following reasoning:
Peter is a human;
Mary is Peter's niece;
Adam is Peter's nephew;
Mary is Bob's grandchild;
Stephen and Mary are twins.

a) Define a signature: $S = (N_C, N_R, N_O)$

Answer:

$N_C = \{Human, Man, Woman, Aunt, Uncle, Grandfather, Grandmother, Twin, Sibling, Nephew, Niece, Father\}$

$N_R = \{hasSibling, hasNephew, hasNiece, hasGrandChild, hasSameBirthDate, hasSameParents, hasChild\}$

$N_O = \{Peter, Mary, Bob, Stephen, Adam\}$

Task 1. Modelling T-Box and A-Box

Assume there is an ALC knowledge base with the following reasoning:
Peter is a human;
Mary is Peter's niece;
Adam is Peter's nephew;
Mary is Bob's grandchild;
Stephen and Mary are twins.

b) Define a T-Box in ALC for the given scenario.

>>> T-Box to specify knowledge about concepts and roles

Answer:

$$
\begin{aligned}
&\mathrm{T} = \{\\
&\mathrm{Man} \cup Woman \subseteq Human\\
&Aunt \subseteq Woman \cap (\exists hasNephew.\top \cup \exists hasNiece.\top)\\
&Uncle \subseteq Man \cap (\exists hasNephew.\top \cup \exists hasNiece.\top)\\
&Grandfather \subseteq Man \cap \exists hasGrandChild.\top\\
&Grandmother \subseteq Woman \cap \exists hasGrandChild.\top\\
&Father \subseteq Man \cap \exists hasChild.\top\\
&Twin \subseteq \forall hasSameBirthDate.Sibling \cap \forall hasSameParents.Sibling\\
&Sibling \subseteq \exists hasSibling.\top\\
&\}
\end{aligned}
$$

Task 1. Modelling T-Box and A-Box

Assume there is an ALC knowledge base with the following reasoning:
Peter is a human;
Mary is Peter's niece;
Adam is Peter's nephew;
Mary is Bob's grandchild;
Stephen and Mary are twins.

c) Define an A-Box in ALC for the given scenario.

>>> A-Box to specify properties of objects

Answer:

A={
Peter : Human,
Peter, Bob, Stephen, Adam : Man,
Mary : Woman,
(Peter, Mary) : hasNiece,
(Peter, Adam), (Peter, Stephen) : hasNephew,
(Bob, Mary) : hasGrandChild,
(Bob, Stephen) : hasGrandChild,
(Stephen, Mary) : hasSibling,
(Stephen, Mary) : hasSameBirthDate,
(Stephen, Mary) : hasSameParents
}

Task 2. Interpretation

Consider the following list of statements:
1. A Person can be either a Student, a Teacher or a Parent.
2. The concepts Student, Teacher and Parent are mutually exclusive.
3. Some Students only *take* Seminars.
4. There are Parents who *manage* a Company that *employs* at least one Student.
5. There are Students that only *have parents* that *manage* or *work* for a Company that *employs* at least one Student.
6.Parents cannot *teach* Courses.
7.Only Students can *take* Courses.

a) Formalise each of the statements in ALC.

Answer:

1. $\text{Person} \subseteq Parent \cup Student \cup Teacher$
2. $(Parent \cap (Teacher \cup Student)) \cup (Teacher \cap Student) \subseteq \bot$
3. $Student \cap \quad \forall takes.Seminar$
4. $Parent \cap \exists manage.(Company \cap \exists employs.Student)$
5. $Students \cap \forall hasParent.(manage.(Company \cap \exists employs.Student) \cup works.(Company \cap \exists employs.Student))$
6. $\exists teaches.Course \cap Parent \subseteq \bot$
7. $\exists takes.Course \subseteq Student$

Task 2. Interpretation

Consider the following list of statements:
1. A Person can be either a Student, a Teacher or a Parent.
2. The concepts Student, Teacher and Parent are mutually exclusive.
3. Some Students only *take* Seminars.
4. There are Parents who *manage* a Company that *employs* at least one Student.
5. There are Students that only *have parents* that *manage* or *work* for a Company that *employs* at least one Student.
6.Parents cannot *teach* Courses.
7.Only Students can *take* Courses.

a) Formalise each of the statements in ALC.

What is the difference:

3.. $Student \cap \forall takes\,.\,Seminar >>> VS <<< Student \cap \exists takes\,.\,Seminar$

6.. $\forall teaches\,.\,Course \cap Parent \subseteq \bot >>> VS <<< \exists teaches\,.\,Course \cap Parent \subseteq \bot$

7.. $\forall takes\,.\,Course \subseteq Student >>> VS <<< \exists takes\,.\,Course \subseteq Student$

Task 2. Interpretation

Consider the following list of statements:
1. A Person can be either a Student, a Teacher or a Parent.
2. The concepts Student, Teacher and Parent are mutually exclusive.
3. Some Students only *take* Seminars.
4. There are Parents who *manage* a Company that *employs* at least one Student.
5. There are Students that only *have parents* that *manage* or *work* for a Company that *employs* at least one Student.
6.Parents cannot *teach* Courses.
7.Only Students can *take* Courses.

b) Define a model for the T-Box you defined in the previous step.

Answer:

$$I = (\triangle^I, .^I), \triangle^I = \{s1,t1,p1,n1,m1,c1\}$$

$Person^I = \{s1,t1,p1\}$
$Student^I = \{s1\}$
$Teacher^I = \{t1\}$
$Parent^I = \{p1\}$
$Seminar^I = \{n1\}$
$Course^I = \{c1\}$
$Company^I = \{m1\}$

$takes^I = \{(s1,c1),(s1,n1)\}$
$teaches^I = \{(t1,c1),(t1,n1)\}$
$works^I = \{(p1,m1)\}$
$manages^I = \{(p1,m1)\}$
$employs^I = \{(m1,s1)\}$
$hasParent^I = \{(s1,p1))\}$

Exercise 1. ALC

1. $N_C = \{Man, Engineer, Rich, Famous\}$
2. $N_R = \{hasChild, hasFriend\}$

Define a concept *happyMother* of a woman, who is a mother of children who are all engineers and have rich or famous friends.

$$happyMother \subseteq \neg Man \cap \exists hasChild\,.\,\top \cap \forall hasChild\,.\,(Engineer \cap \exists hasFriend\,.\,(Rich \cup Famous))$$

Exercise 2. ALC

1. $N_C = \{Man, Car, UnderAge, Permission\}$
2. $N_R = \{drives, owns\}$

Write a statement to describe a man who drives a car, holds a driving license and is an under-age.

$$Man \cap \exists drives\,.\,Car \subseteq UnderAge \cap \exists owns\,.\,Permission$$

Exercise 3. ALC

1. $N_C = \{Man, Car, Suspension, Broken\}$
2. $N_R = \{drives, hasPart\}$

A man that drives a car with a suspension that is broken.

$$Man \cap \exists drives\,.\,(Car \cap \exists hasPart\,.\,(Suspension \cap Broken))$$

Questions?