

## Semantic Web Services

**Exercise sheet 8****WSML****Exercise 1 (WSML ontology modeling (1)) (6 points)**

Given the ontology in Listing 1, representing the knowledge about a famous american cartoon.

Listing 1: Simpson Ontology

```
wsmlVariant _"http://www.wsmo.org/wsml/wsml-syntax/wsml-flight"  
namespace { _"http://ontologies.sti2.at/"  
,  
  wsml _"http://www.wsmo.org/wsml/wsml-syntax#",  
  dc _"http://purl.org/dc/elements/1.1/" }  
  
ontology simpsons  
  
concept gender  
  
concept character  
  hasName ofType string  
  hasGender ofType gender  
  hasSpouse ofType character  
  hasChild ofType character  
  hasParent ofType character  
  hasSibling ofType character  
  hasFriend ofType character  
  hasCatchPhrase ofType string  
  inLoveWith ofType character  
  isCustomerOf ofType workplace  
  hasWorkingPlace ofType place  
  attends ofType school  
  
instance male memberOf gender  
  
instance female memberOf gender  
  
instance homer simpson memberOf character  
  annotations  
    dc#title hasValue "Homer J Simpson"  
  endAnnotations  
  hasName hasValue "Homer J Simpson"  
  hasGender hasValue male  
  hasSpouse hasValue marge_simpson  
  hasParent hasValue abe_simpson
```

```
hasChild hasValue {bart_simpson, lisa_simpson, maggie_simpson }

instance marge_simpson memberOf character
  annotations
    dc#title hasValue "Marge Simpson"
  endAnnotations
  hasName hasValue "Marge Simpson"
  hasGender hasValue female
  hasSpouse hasValue homer_simpson
  hasChild hasValue {bart_simpson, lisa_simpson, maggie_simpson}
  hasSibling hasValue {patty_bouvier, selma_bouvier }

instance lisa_simpson memberOf character
  annotations
    dc#title hasValue "Lisa Simpson"
  endAnnotations
  hasName hasValue "Lisa Simpson"
  hasGender hasValue female
  hasParent hasValue {homer_simpson, marge_simpson }
  hasSibling hasValue {bart_simpson, maggie_simpson }

instance bart_simpson memberOf character
  annotations
    dc#title hasValue "Bart Simpson"
  endAnnotations
  hasName hasValue "Bart Simpson"
  hasGender hasValue male
  hasParent hasValue {homer_simpson, marge_simpson }
```

Define:

1. An axiom that states that all married people are in love with their spouse.
2. A logical expression to find out who is in love with whom in the Simpsons world.
3. An axiom that states that if a character A is sibling with a character B then also the B is sibling with A.
4. An axiom that defines the mother of a character as parent of female gender.
5. An axiom that states that male and female characters are disjoint.

## Exercise 2 (WSML ontology modeling (2)) (6 points)

In the context of the VTA scenario, introduced in Exercise Sheet 4, let's consider an imaginary hotel company, called *The Blue Hotel* that allows its clients to check for room availability using the *BlueHotelService*. The WSLD description of the *BlueHotelService* is available in Listing 2. Create a WSML ontology for the description of the hotel domain and a service description for the Blue Hotel. Include also the choreography definition in the service description.

Listing 2: WSDL description of BlueHotelService

```
<?xml version="1.0" encoding="utf-8" ?>
<description
  xmlns="http://www.w3.org/ns/wsdl"
  targetNamespace="http://www.bluehotel.com/wsdl/BlueHotelService"
  xmlns:tns="http://www.bluehotel.com/wsdl/BlueHotelService"
  xmlns:bhns="http://www.bluehotel.com/schemas/BlueHotelService"
  xmlns:soap="http://www.w3.org/ns/wsdl/soap"
  xmlns:soap="http://www.w3.org/2003/05/soap-envelope"
  xmlns:w3org="http://www.w3.org/ns/wsdl-extensions">

  <documentation>
    This document describes the Blue Hotel Web service.
  </documentation>

  <types>
    <xs:schema
      xmlns:xs="http://www.w3.org/2001/XMLSchema"
      targetNamespace="http://www.bluehotel.com/schemas/BlueHotelService"
      xmlns="http://www.bluehotel.com/schemas/BlueHotelService">
      <xs:element name="checkAvailability" type="tCheckAvailability"/>
      <xs:complexType>
        <xs:sequence>
          <xs:element name="checkInDate" type="xs:date"/>
          <xs:element name="checkOutDate" type="xs:date"/>
          <xs:element name="roomType" type="xs:string"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>

    <xs:element name="checkAvailabilityResponse" type="tCheckAvailabilityResponse"/>
    <xs:complexType>
      <xs:sequence>
        <xs:element name="roomType" type="xs:string"/>
        <xs:element name="rateType" type="xs:string"/>
        <xs:element name="rate" type="xs:double"/>
      </xs:sequence>
    </xs:complexType>
    </xs:element>

    <xs:element name="invalidDataError" type="xs:string"/>
  </xs:schema>
</types>

<interface name = "BlueServiceInterface" >
  <fault name = "invalidDataFault" element = "bhns:invalidDataError"/>

  <operation name="opCheckAvailability"
    pattern="http://www.w3.org/ns/wsdl/in@out"
    style="http://www.w3.org/ns/wsdl/style/iri"
    wsdl:safe = "true">
    <input messageLabel="In" element="bhns:checkAvailability" />
    <output messageLabel="Out" element="bhns:checkAvailabilityResponse" />
    <outfault ref="tns:invalidDataFault" messageLabel="Out"/>
  </operation>
</interface>
```

```

<binding name="BlueServiceSOAPBinding"
  interface="tns:BlueServiceInterface"
  type="http://www.w3.org/ns/wsdl/soap"
  wsoap:protocol="http://www.w3.org/2003/05/soap/bindings/HTTP/">
  <fault ref="tns:invalidDataFault" wsoap:code="soap:Sender"/>
  <operation ref="tns:opCheckAvailability"
    wsoap:mep="http://www.w3.org/2003/05/soap/mep/soap@response"/>
</binding>

<service name="BlueService" interface="tns:BlueServiceInterface">
  <endpoint name="reservationEndpoint"
    binding="tns:BlueServiceSOAPBinding"
    address="http://www.bluehotel.com/BlueService"/>
</service>
</description>

```

### Exercise 3 (WSML service modeling) (4 points)

Extend the travel ontology presented in Listing 3 by introducing the bus travels, time-tables and routes. Define a service for the public transport system of Innsbruck capable of providing: the departures from a given bus stop, the next bus stop on the route.

Listing 3: Travel ontology

```

wsmlVariant _http://www.wsmo.org/wsml/wsml-syntax/wsml-flight

namespace { _"http://www.gsmo.org/dip/travel/domainOntology#",
  dc_"http://purl.org/dc/elements/1.1#",
  wsml_"http://www.wsmo.org/wsml/wsml-syntax#"}

ontology TravelOntology

concept Ticket
  annotations
    dc#description hasValue "concept of a ticket"
  endAnnotations
  from ofType Region
  to ofType Region
  vehicle ofType Vehicle

concept Region

concept Country subConceptOf Region
  name ofType string

concept City subConceptOf Region
  name ofType string
  country ofType Country

concept EUCity subConceptOf City

concept GermanCity subConceptOf EUCity

concept AustrianCity subConceptOf EUCity

concept UKCity subConceptOf EUCity

concept USCity subConceptOf City

```

```
concept Vehicle
  seats ofType integer

concept Airplane subConceptOf Vehicle

concept Train subConceptOf Vehicle

axiom GermanCityDef
  definedBy
    ?city memberOf GermanCity implies ?city[country hasValue Germany].

axiom AustrianCityDef
  definedBy
    ?city memberOf AustrianCity impliedBy ?city[name hasValue "Austria"] memberOf country.

axiom UKCityDef
  definedBy
    ?city memberOf UKCity implies ?city[country hasValue UK].

instance Innsbruck memberOf AustrianCity

instance Germany memberOf Country
  name hasValue "Germany"

instance UK memberOf Country
  name hasValue "United Kingdom"

instance Austria memberOf Country
  name hasValue "Austria"
```

#### Exercise 4 (WSML goal modeling) (4 points)

Define a goal for booking a double room for non smokers according to the ontology modeled in Exercise 3.