1. (8 points) Identify all of the following statements that are true about the basic Web services standards.
   
   A. WSDL helps us specify the conversations that are supported by services but falls short of specifying business protocols
   B. All current Web services, e.g., those offered by Google, ultimately involve the use of SOAP to invoke them
   C. UDDI helps in the discovery of Web services based on their tModels
   D. WSDL takes advantage of XML Schema to describe the types of parameters and results

   **Solution:** C and D

2. (8 points) Identify all of the following statements that are true about value maps (considering a function from one value set to another, and its inverse):
   
   A. A value map that satisfies consistent inversion must necessarily satisfy order preservation
   B. If two sets have the same number of members, the value maps between them must be consistently inverting
   C. If a value map is consistently inverting, then its inverse is also consistently inverting
   D. If a value map is order preserving, then so its inverse

   **Solution:** None

3. (16 points) One’s paternal grandmother is one’s father’s mother. Consider a scenario where the following are already defined:
   
   - Classes: Person with two mutually exclusive and exhaustive subclasses Male and Female
   - Properties: parentOf and its inverse childOf

   Identify all of the following OWL DL statements that are correct definitions of the class of paternal grandmothers.

   A. `<owl:Class rdf:ID="PaternalGrandMother-1">`  
      `<owl:intersectionOf rdf:parseType="Collection">`  
      `<owl:Class rdf:about="#Female"/>`  
      `<owl:Restriction>`  
      `<owl:onProperty rdf:resource="#parentOf"/>`  
      `<owl:someValuesFrom>`  
      `<owl:intersectionOf rdf:parseType="Collection">`  
      `<owl:Class rdf:about="#Male"/>`  
      `<owl:Restriction>`  
      `<owl:onProperty rdf:resource="#parentOf"/>`  
      `<owl:someValuesFrom rdf:resource="#Person"/>`  
      `<owl:Restriction>`  
      `<owl:intersectionOf rdf:parseType="Collection">`  
      `<owl:Class>`  
      `<owl:intersectionOf>`  
      `<owl:someValuesFrom>`  
      `<owl:Restriction>`  
      `<owl:intersectionOf>`  
      `<owl:someValuesFrom>`  
      `</owl:Class>`
B. <owl:Class rdf:ID="PaternalGrandMother-2">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Male"/>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#parentOf"/>
      <owl:someValuesFrom>
        <owl:intersectionOf rdf:parseType="Collection">
          <owl:Class rdf:about="#Female"/>
          <owl:Restriction>
            <owl:onProperty rdf:resource="#parentOf"/>
            <owl:someValuesFrom rdf:resource="#Person"/>
          </owl:Restriction>
        </owl:intersectionOf>
      </owl:someValuesFrom>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>

C. <owl:Class rdf:ID="Anon-1">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Male"/>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#parentOf"/>
      <owl:someValuesFrom rdf:resource="#Person"/>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>

<owl:Class rdf:ID="PaternalGrandMother-3">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Female"/>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#parentOf"/>
      <owl:someValuesFrom rdf:resource="#Anon-1"/>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>

D. <owl:Class rdf:ID="Anon-2">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Female"/>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#childOf"/>
      <owl:someValuesFrom rdf:resource="#Person"/>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>

<owl:Class rdf:ID="PaternalGrandMother-4">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Male"/>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#childOf"/>
      <owl:someValuesFrom rdf:resource="#Anon-2"/>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>
<owl:Class>

Solution: A and C