Three hours

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Web Technology and Practice 2

QUESTION PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

Date: Wednesday 27th May 2009
Time: 14:00 – 17:00

Please answer ALL Questions in Section A (40 marks available)

Answer ONE Question in Section B (20 marks available)

and ONE Question in Section C (20 marks available)

Use a separate answerbook for EACH section. Do not answer more than the required number of questions. Additional questions will not be marked. Clearly cross out anything you do not wish to be marked.

The use of electronic calculators is NOT permitted
Section A

Compulsory multi-part question—Answer all parts (40 marks)

A1. Give 5 advantages of XML Schemas as compared to DTDs.. (5 marks)

A2. Consider the following snippet of an XML schema (lines are numbered for ease of reference):

(1)  <xsd:schema xmlns:xsd=http://www.w3.org/2001/XMLSchema
(3)    targetNamespace=http://www.books.org
(4)    xmlns=http://www.books.org
(5)    elementFormDefault="qualified">

Using this snippet, explain the notion of XML namespaces and how they are used. Explain also how schemaLocation from the XMLSchema-instance namespace is used to connect an XML instance document with its XML schema. (5 marks)

A3. Consider the following XML schema and DTD (lines are numbered for ease of reference):

(1)  <?xml version="1.0"?>
(2)  <xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
(3)    targetNamespace="http://www.juicers.org"
(4)    xmlns="http://www.juicers.org"
(5)    elementFormDefault="qualified">
(6)    <xsd:element name="warranty" type="xsd:string"/>
(7)    <xsd:element name="guarantee" substitutionGroup="warranty" type="xsd:string"/>
(8)    <xsd:complexType name="appliance">
(9)        <xsd:sequence>
(10)           <xsd:element name="description" type="xsd:string"/>
(11)           <xsd:element ref="warranty" minOccurs="0"/>
(12)       </xsd:sequence>
(13)    </xsd:complexType>
(14)  <xsd:complexType name="juiceAppliance">
(15)      <xsd:complexContent>
(16)          <xsd:extension base="appliance">
(17)             <xsd:sequence>
(18)                <xsd:element name="name" type="xsd:string"/>
(19)                <xsd:element name="image" type="imageType"/>
(20)                <xsd:element name="weight" type="xsd:positiveInteger" minOccurs="0"/>
(21)                <xsd:element name="cost" type="money" maxOccurs="unbounded"/>
(22)                <xsd:element name="retailer" type="xsd:anyURI"/>
(23)          </xsd:sequence>
(24)      </xsd:extension>
(25)  </xsd:complexType>
The writer of the above XML schema was in the process of producing it on the basis of the DTD. Complete the job by modifying the XML schema to incorporate the attributes mentioned in the DTD. Use appropriate XML Schema datatypes. **You need not reproduce the entire schema.** It is sufficient to show the detail of the changes you would make, indicating where in the schema any modifications would be made. (10 marks)
A4. Referring to the failure model of distributed systems, what types of failures might distributed systems experience? In your answer, provide a brief description for each type of failure you identify. (5 marks)

A5. Security is one of the major concerns when using a distributed system. Briefly describe the threats that cannot be defeated by secure channels or other cryptographic techniques; and explain how to defend against them. (5 marks)

A6. Compare and contrast the RPC (Remote Procedure Call) style of Web Service with GWT RPC (Google Web Toolkit Remote Procedure Call). (10 marks)
Section B

Answer ONE question in this Section

B1. AJAX is becoming popular.
   a) What is AJAX and what are the benefits from its asynchronous communication support? (5 marks)
   b) Compare and contrast AJAX with Java Applet to highlight their strengths and weaknesses. Describe each technology in turn by listing its advantages and weaknesses, and provide an overall conclusion stating under which circumstances each can be used to greatest benefit. (15 marks)

B2. DataLab is a quantitative data analysis consultancy company. The company has a desktop application for experiment data analysis. The software has a graphical user interface for scientists to input and analyse the data obtained from experiments. With the recent advances in rich Internet application technology, the company decides to develop a Rich Internet Application (RIA) to replace their desktop based system. This Web application should provide rich user experience that is similar to its desktop based version. As a Web application developer, you are invited to design and develop this application.
   a) Describe your chosen system architecture of the Web application. (5 marks)
   b) Describe and justify your chosen RIA technology and development framework for this application. (8 marks)
   c) Explain why the Web application to be implemented using your chosen technology can provide the kind of rich user experience similar to its desktop version. (7 marks)
Section C

Answer ONE question in this Section

C1. a) Consider the following instance of an XML document, its HTML transform, and its partial XSLT stylesheet.

```xml
<?xml version="1.0"?>
<?xml-stylesheet type="text/xsl" href="donewstudent.xsl"?>
<groups>
  <group number="1">
    <student name="I.M. Dreeming" id="20092">
      <degree>
        Software Engineering
      </degree>
      <course code="1234">
        Programming by Stealth
      </course>
      <course code="3456">
        Requirements Capture
      </course>
      <course code="0123">
        Human Computer Interaction
      </course>
    </student>
    <student name="Nabla Niblick" id="20090">
      <degree>
        Internet Technologies
      </degree>
      <course code="1234">
        Programming by Stealth
      </course>
      <course code="2345">
        Internet Secrets
      </course>
    </student>
  </group>
  <group number="2">
    <student name="X. Yme" id="20093">
      <degree>
        Software Engineering
      </degree>
      <course code="3456">
        Requirements Capture
      </course>
    </student>
  </group>
</groups>
```
<course>
  <course code="0123">
    Human Computer Interaction
  </course>
</student>
@student name="Puranna Wistchill" id="20091">
  <degree>
    Internet Technologies
  </degree>
  <course code="1234">
    Programming by Stealth
  </course>
  <course code="2345">
    Internet Secrets
  </course>
</student>
</group>
</groups>

<html>
<body>
<h1>Students in groups</h1>
<table border="1">
  <TR>
    <TD>Group</TD><TD>Name</TD><TD>ID</TD>
  </TR>
  <TR>
    <TD>1</TD><TD>Nabla Niblick</TD><TD>20090</TD>
  </TR>
  <TR>
    <TD>1</TD><TD>I.M. Dreeming</TD><TD>20092</TD>
  </TR>
  <TR>
    <TD>2</TD><TD>X. Yme</TD><TD>20093</TD>
  </TR>
  <TR>
    <TD>2</TD><TD>Puranna Wistchill</TD><TD>20091</TD>
  </TR>
</table>
</body>
</html>

[Question C1.a) continues on the following page]
On line 11, what should replace MISSING1?
For lines 12, 13 and 14, state what you would normally expect to go in the place of ???1, ???2 and ???3.

For line 16, give two different equivalent location paths that could be used to achieve the same effect.

On lines 17 and 18, what should replace MISSING2?
On line 18, what should replace MISSING3?
On line 20, what should replace MISSING4?
b) The same XML document, of unknown size, is regularly generated and is to be used by two different applications. The first is designed to use it to allow a user to explore a tree view of data, as in a file manager. The second is designed to use data values held in the document to create a 2D graphic display onscreen. Given the choice between DOM and SAX approaches, say which approach(es) you would adopt for implementing these applications. Justify your decisions, explaining the advantages and disadvantages of DOM and SAX with respect to these applications. Assess to what extent web technologists need to be proficient in both approaches.  

(10 marks)

C2. a) i) While programming in a JavaServer Pages (JSP) environment, I create a Java Servlet, a Java Bean and a JSP. I have used a Model-View-Controller approach. State which of the three (Servlet, Bean, JSP) is the Model, which the View and which the Controller.  

(3 marks)

ii) Describe the different roles of Model, View and Controller.  

(2 marks)

b) I write the following in my JSP, as part of an attempt to store session information:

```java
<%! 
int globalCounter=0; 
%>
```

Assess to what extent this is a good strategy. Justify your answer.  

(2 marks)

c) The following are ways of evoking dynamic code involving JSPs. Some are more suitable for simple applications or small development teams, others are more suitable for complex applications or large development teams. Place these ways on a spectrum (simple/small ... complex/large). Justify the place of each on the spectrum, discussing the advantages/disadvantages of each.

- Use Java Beans
- Use custom tags
- Call Java code directly
- Use MVC architecture
- Call Java code indirectly
- Use JSP Expression Language (EL)  

(8 marks)

d) A client is implementing a Web service and wishes you to advise on whether he should choose a Simple Object Access Protocol (SOAP) or a Representative State Transfer (REST) based approach. State what issues you would explore with the client regarding his requirements, and his servers and services environment, to enable a rational choice. Critically assess the advantages and disadvantages of each approach.  

(5 marks)

END OF EXAMINATION