Birkbeck
(University of London)

MSc and MRes Examination for Internal Students
MSc in Advanced Information Systems
MRes in Computer Science
MSc in E-Commerce

School of Computer Science and Information Systems

Development of Internet Applications (ECOMM105)

Monday 24 May 2004 (14:30–16:30)

There are SEVEN questions on this paper. MSc AIS and MRes candidates should attempt FOUR of Questions 1 to 6, while MSc E-Commerce candidates should attempt FOUR of Questions 1, 2, 3, 4, 5 and 7. Calculators are not permitted.

1. (a) What are the names of the 5 entities that are built-in to XML? What syntax is used to refer to an entity in a document? (6 marks)

   (b) Using an example, explain what is meant by locally-scoped element names declared in an XML schema. Explain why the same effect can or cannot be achieved using a DTD? (7 marks)

   (c) Three of the axes defined in XPath are called `following`, `following-sibling` and `descendant`. For each pair of axes from these three, explain why they do or do not overlap. (Two axes overlap if there is a context node in an XML document such that the axes with respect to the context node have a node in common.) (6 marks)

   (d) How do Web servers differentiate among the various technologies used for server-side processing that might be targetted by an incoming request? (6 marks)

2. (a) Explain with the help of a suitable example the problems associated with using namespaces together with DTDs. (10 marks)

   (b) Assuming some context node, explain precisely what the XPath expression

   ```
   CD [@publisher="Deutsche Grammophon"] [count(performance) > 2]
   ```

   returns. (7 marks)

   (c) Assume that the following URL is typed into the address (or location) field of a Web browser

   `http://eros.dcs.bbk.ac.uk/dept/staffperson.asp?name=ptw`

   and that the following fragment of code is part of the file `staffperson.asp` accessed by the browser as a result of retrieving the URL:

   ```
   strSQLQuery = "select * from staff
                  where username = '" &
                  Request.QueryString.Item("name") & "'"
   ```

   Explain what the above code does when it is executed, paying particular attention to the last line. (8 marks)

3. (a) Consider the following XML document:

```
<?xml version="1.0"?>
<!DOCTYPE memo [
<!ELEMENT memo      (from, to+, subject?, paragraph+)>
<!ELEMENT paragraph (#PCDATA)>
<!ATTLIST memo
  type (normal|urgent) normal>
]>
<memo>
  <from>The President</from>
  <paragraph>This is <em>very</em> important</paragraph>
</memo>
```

i. What do the operators + and ? mean? (2 marks)

ii. What would the XSLT instruction

```
<xsl:value-of select="/memo/@type"/>
```

return and why? (3 marks)

iii. Give all of the reasons why the above document is not valid. (4 marks)

(b) For each of the following 3 XPath location steps which use the *abbreviated* syntax, write down the equivalent location step using the *full* syntax:

i. `/./`

ii. `/../`

iii. `//`

(6 marks)

(c) Explain the purposes of *replication* and *caching* on the Web, as well as the differences between these two concepts. (10 marks)

4. (a) Define a type in XML schema called `fileType`, to be used as the type for XML elements representing computer files. It should meet the following requirements. A file has a name, a date and time of last modification, and information about permissions. There are two sets of permissions granted: one for the owner of the file and one for all other users. In each case there can be between 1 and 3 permissions granted. Each permission must be one of the 3 strings `read`, `write` or `execute`. (14 marks)

(b) Now write down an XML element named `file` whose contents conforms to the type `fileType` you defined in part 4a. (6 marks)

(c) What does it mean to say that HTTP is stateless? (2 marks)

(d) Name 3 request methods used by HTTP and describe what each method does. (3 marks)

5. (a) Consider the following document type declaration for documents representing results of students on a given degree programme:

```
<!DOCTYPE programme [
<!ELEMENT programme   (degree, year, results)>
<!ELEMENT results     ((distinction)?, (merit)?, (pass)?, (fail)?)>
<!ELEMENT distinction ((name)*)>
<!ELEMENT merit       ((name)*)>
<!ELEMENT pass        ((name)*)>
<!ELEMENT fail        ((name)*)>
]>
```

Those element names without content models specified are assumed to have `#PCDATA` as their content models. Write a set of XSLT template rules to transform an XML document of type `programme` into an HTML document as follows. The document should start with an `h1` heading containing the value of the `degree` element, followed by the value of the `year` element in parentheses. This heading should be followed by an HTML table in which each row comprises the name of a student followed by their degree classification. (13 marks)

(b) Name 4 event attributes in HTML 4.0 that can be linked to scripts. (4 marks)

(c) Explain the meaning of the terms *proxy* and *gateway* as used by HTTP and describe the differences between them. (8 marks)

6. **This question may be answered only by MSc AIS and MRes students**

(a) Describe the characteristics of the Object Exchange Model for semi-structured data, presenting some advantages and disadvantages of such a model. (10 marks)

(b) Give an example of a document constraint that cannot be specified using XML schema. Now show how this constraint can be modelled using either a regular tree grammar or RELAX NG. (10 marks)

(c) Define what it means to state that two XPath query expressions are *equivalent*. How can equivalence be used in query optimisation? (5 marks)

7. **This question may be answered only by MSc E-Commerce students**

(a) Compare and contrast the traditional e-commerce approach to business profitability with that of the emerging e-services approach. (10 marks)

(b) Write a script in JavaScript which is to be embedded in an HTML document and which does the following. It reads an XML file called `file.xml` and outputs into the HTML document the values of all the `price` elements that occur anywhere in `file.xml`, each `price` appearing inside HTML paragraph elements. (15 marks)

