Birkbeck
University of London

MSc Electronic Commerce

Development of Internet Applications

Friday 7th June 2002 (10:00–12:00)

There are six questions on this paper. Candidates should attempt FOUR of them. Calculators are not permitted.

1. (a) Discuss the advantages of using XML rather than HTML when exchanging information, particularly with reference to e-commerce applications. (6 marks)

   (b) Given an XML document, explain what the XPath expression

   ```
   /descendant::section[descendant::image]/child::title
   ```

   returns when applied to the document. (4 marks)

   (c) Assume that information concerning papers published in conference proceedings is represented in XML. Each paper has one or more authors associated with it. XSLT is to be used to transform the XML data so that, in the output for each paper, each author other than the last is followed by a comma while the last author is followed by a fullstop. Show how this can be done by writing a fragment of XSLT code for author elements. (7 marks)

   (d) Explain the purpose of the Document Object Model (DOM), what facilities it provides for programmers, and some of its advantages. (8 marks)

2. (a) Explain five advantages that XML schema provides in comparison to DTDs. (5 marks)

   (b) XPath views an XML document as a tree of nodes. With the help of an appropriately annotated diagram and assuming a particular context node, explain what is meant by the following: the `preceding`, `following`, `ancestor`, `descendant` and `self` axes together partition the tree into 5 subtrees. (8 marks)

   (c) Write a Javascript script which will prompt the user to enter an integer n which will be used to construct an HTML table of squares of integers up to and including n. The table should have two columns: the first for the integer n and the second for the square of n. (12 marks)

3. (a) Discuss the need for namespaces in XML. (4 marks)

   (b) Consider the following DTD fragment for defining documents of type `supplier-list`:

   ```
   <!ELEMENT supplier-list (supplier+) >
   <!ELEMENT supplier      (name, part+) >
   <!ELEMENT part          (number, description?) >
   ```

   along with a second DTD fragment for defining documents of type `part-list`:

   ```
   <!ELEMENT part-list (part+) >
   <!ELEMENT part      (number, description, supplier) >
   ```

   All elements not declared (`name`, `number` and `description`) are assumed to have content models of `#PCDATA`. A document of type `supplier-list` groups all the parts supplied by a particular supplier under that supplier, while a document of type `part-list` includes the supplier along with each part.

Write a single XSLT template rule that will transform a document of type `supplier-list` into an equivalent one of type `part-list`. If there is no `description` element in the `supplier-list` document, then the `description` element in the `part-list` document should have contents of "n/a" (without the quotes). The value of the `supplier` element in the `part-list` document should the value of the corresponding `name` element in the `supplier-list` document. (16 marks)

(c) Name five server-side processing technologies. (5 marks)

4. (a) What is an XML entity? Distinguish between a general entity and a parameter entity. Give an example of a general entity declaration, followed by a reference to the same entity. (10 marks)

(b) Explain the *expiry model* used in HTTP caching. (15 marks)

5. (a) Consider the following two element declarations from an XML DTD:

```
<!ELEMENT CD          (composer, (performance)+, (length)?)>
<!ELEMENT performance (composition, (orchestra, conductor)?)>
```

where all elements not declared are assumed to have content models of `#PCDATA`.

i. Write down an XML document of type `CD` that is valid with respect to the above DTD using the fewest number of elements possible. (4 marks)

ii. Write down the XML schema declarations equivalent to the above DTD. (12 marks)

(b) Describe some of the advantages of using URNs rather than URLs to specify resources. With the help of a diagram, explain the steps a browser would have to take in order to retrieve a resource specified to it using a URN. (9 marks)

6. (a) Assume that we want to allow people's names to be represented as a `name` element in XML using child elements `first-name`, `first-initial`, `middle-initial` and `last-name`.

i. Write a content model for the `name` element in an XML DTD which allows only the following five sequences of child elements to occur:

```
last-name
first-initial, last-name
first-name, last-name
first-initial, middle-initial, last-name
first-name, middle-initial, last-name
```

Your content model must refer to each element name *only once*. (7 marks)

ii. Now assume that the `name` element is to be used as a child of both a `recipient` element and a `signature` element. When `name` is a child of `recipient`, it should have one of the five forms above. When `name` is a child of `signature`, it must have `first-name` and `last-name` (with `middle-initial` being optional). Write the necessary DTD content models to capture these requirements, or explain why this cannot be done. (3 marks)

(b) Explain the meaning of the terms *persistent connection* and *pipelining* with respect to the HTTP protocol. What are the advantages and consequences of each? (15 marks)