THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS
BCS Level 6 Professional Graduate Diploma in IT

WEB ENGINEERING

2nd May 2007, 10.00 a.m.-1.00 p.m.
Answer THREE questions out of FIVE. All questions carry equal marks.
Time: THREE hours.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

Calculators are NOT allowed in this examination.

1. *a)* Briefly explain how an XML document can be rendered as a web page with reference to DTD and XSLT.
(3 marks)

b) Referring to the XML document in **Figure 1** on the next page, write a DTD which **enforces** the following NINE constraints:

- sequence of elements is as shown in the XML code above (i.e. `ModuleCatalogue` is a container of `Module` elements).
- `Module` element must be present zero or more times.
- The two attributes in `Module` are mandatory.
- Exactly one `credit` element must be present
- Exactly one `module_leader` element must be present
- `module_leader_email` element is optional
- `module_url` element is optional
- `module_url` is an EMPTY element
- At least one `text_book` element must be present

(9 marks)

c) Refine the `text_book` element to give the details of the books as:

Author Name, Book Title, Year of Publication, Publisher, ISBN Number

where Author name, Book title and ISBN number are required, and the others optional. e.g. A. Photh, "Image Manipulation", 2001, BCS Press, ISBN: 0-123-123456 **(3 marks)**

d) The website designers wish the XML list of Modules to be displayed as a web page as indicated in **Figure 2** (overleaf). Using the template provided in **Figure 3** (on page 3 of this paper), complete the missing code (the section marked `<!—TO BE COMPLETED -->`) to accomplish this. **(8 marks)**

e) Modify your code to display the modules by levels. **(2 marks)**

```
1 : <?xml version="1.0" encoding="ISO-8859-1"?>
2 : <ModuleCatalogue>
3 :    <Module code = "AD40029" level ="4">
4 :      <module_title> 3D Images</module_title>
5 :      <credit> 20 </credit>
6 :      <module_leader> Dr. View </module_leader>
7 :      <module_leader_email>d.view@3d.com</module_leader_email>
8 :      <module_url page="http://bcs.ac.uk/3dimages.html" />
9 :      <text_book>Image manipulation by A.Photh</text_book>
10:    </Module>
11:
12:    <Module code = "AD40029" level ="5">
13:      <module_title> 3D Modelling</module_title>
14:      <credit> 30 </credit>
15:      <module_leader> Dr. Solid </module_leader>
16:      <module_leader_email>a.solid@3d.com</module_leader_email>
17:      <text_book>3D Modelling by T.Max</text_book>
18:    </Module>
19:
20:    <Module code = "AD50025" level ="5">
21:      <module_title> Game Art Images</module_title>
22:      <credit> 20 </credit>
23:      <module_leader> Dr. Draw </module_leader>
24:      <module_leader_email>d.draw@3d.com</module_leader_email>
25:      <module_url page="http://bcs.ac.uk/gameart.html" />
26:      <text_book>Gaming by S.Mario</text_book>
27:    </Module>
28:
29:    <Module code = "AD40030" level ="4">
30:      <module_title> 2D Animation</module_title>
31:      <credit> 20 </credit>
32:      <module_leader> Dr. Draw </module_leader>
33:      <module_leader_email>d.draw@3d.com</module_leader_email>
34:      <text_book>2D Animation by D.Art</text_book>
35:    </Module>
36: </ModuleCatalogue>
```

Figure 1: XML sample document

Figure 2: Sample Browser Page

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
  <xsl:template match="/">
  <html>
    <body>
      <h2>Module Catalogue</h2>
      <table border="1">
      <tr bgcolor="#9acd32">
      <th align="left">Module Code </th>
      <th align="left">Module Level </th>
      <th align="left"> Module Title</th>
      <th align="left"> Credit</th>
      <th align="left">Module Leader</th>
      <th align="left">Module URL </th>
      <th align="left">Module Text </th>
      </tr>


      <!--TO BE COMPLETED -->



      </table>
    </body>
  </html>
  </xsl:template>
</xsl:stylesheet>
```

Figure 3: Template HTML

2. *a)* Write HTML to construct the form as indicated in **Figure 4** overleaf. When the button marked "Add Videos" is pressed, the form should submit to a script called `video.php`. **(3 marks)**

b) *i)* What are the implications of *not* validating data? **(2 marks)**

ii) Describe, with an example for each, when data should be validated at:
The client end
The server end **(3 marks)**

c) Write code (either at the client side in JavaScript, or at the server side in ASP, PHP, or Perl) to validate that:

i) The `title` field exists, and consists of a combination of alphabetic characters, spaces and digits only.
(4 marks)

ii) The `releasedate` field is in the format "yyyy-mm-dd" where:
'dd' represents a day number between 1 and 31.
'mm' represents a month number between 1 and 12.
'yyyy' represents a year (which can be either 2 or 4 digits in length). **(4 marks)**

The code should return an appropriate and informative error message if the validation fails.

d) The server has a database named **LIBRARY**, with a single table named `Video` (as shown in **Figure 5** overleaf). You may assume the web server and the database server are the same machine.

i) Write code to connect to the database. **(1 mark)**

For parts *ii)* and *iii)* below, assume that the php script `login.php` has already established a valid connection to this database. In all cases, you should state the language you are using (ASP, PHP or Perl).

ii) Write code to store the details submitted from the form into the database. **(3 marks)**

iii) Write code to retrieve and display (in an appropriate format) the details of *all* videos in the database which have been released since 2007-01-01. **(5 marks)**

Please note:
The following SQL syntax may be useful to accomplish these tasks:
```
INSERT INTO tbl_name (col1, col2, …) VALUES (val1, val2, …);
SELECT * FROM tbl_name WHERE col1 >= val1;
```
(Where tbl_name, col1, val1 etc. are to be replaced with appropriate values)

Figure 4: Sample HTML form

```
Database: LIBRARY
┌─────────────────────────────┐
│           Video             │
├─────────────────────────────┤
│ VideoTitle    : varchar(30) │
│ ReleaseDate : date          │
│ Rating        : char(3)     │
└─────────────────────────────┘
```
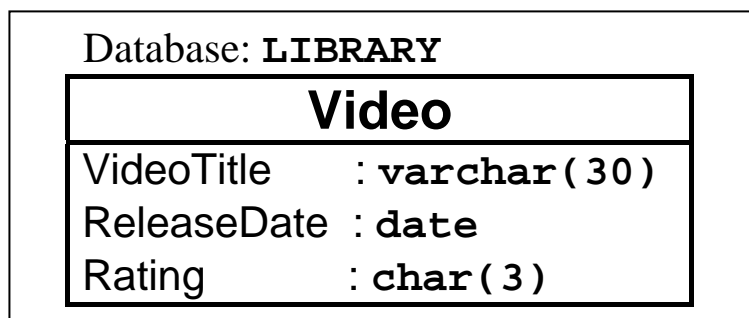
Figure 5: Database Entity-Attribute diagram

3. *a)* Explain, with a suitable realistic example in each case, what is meant by:
   - *i)* *denial of service* (DOS) attack **(2 marks)**
   - *ii)* *cross site scripting* (XSS) attack **(3 marks)**
   - *iii)* *buffer overrun* vulnerability **(3 marks)**

b) For each of the three elements (client, network, server) involved in a web transaction over a conventional wired network, detail TWO security risks to sensitive data and, for each risk identified, list the consequences of a breach of security. **(9 marks)**

c) What additional risks do wireless network connections (such as 802.11b) to the WWW bring, over and above those existing on conventional network connections? Outline possible solutions. **(8 marks)**

```
 1: <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
 2:      "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
 3: <html>
 4:   <head>
 5:     <meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
 6:     <title>BCS Bookshop</title>
 7:     <script type="text/javascript" language="javascript">
 8:     <!--
 9:     function togglegroup(currgroup){
10:         if(document.all){
11:             thisgroup = eval("document.all."+currgroup+".style");
12:
13:             if(thisgroup.display == "block"){
14:                thisgroup.display = "none";
15:             }
16:             else {
17:                thisgroup.display = "block";
18:             }
19:
20:             return false;
21:         }
22:         else {
23:            return true;
24:         }
25:     }
26:     -->
27:     </script>
28:     <style type="text/css">
29:       .group { display:none; margin-left:20px;}
30:     </style>
31:   </head>
32:   <body bgcolor="white">
33:     <h1>Books &amp; Periodicals</h1>
34:     <h3><a href="page1.html" onclick="return togglegroup('group1')">
35:       Books</a></h3>
36:     <p id="group1" class="group">
37:       &quot;Intro to Javascript&quot;<br />
38:       &quot;Golfing, a guide&quot;<br />
39:       &quot;The Complete DOM reference&quot;
40:     </p>
41:     <h3><a href="page2.html" onclick="return togglegroup('group2')">
42:       Magazines</a></h3>
43:     <p id="group2" class="group">
44:       &quot;Hi!&quot;<br />
45:       &quot;People's Monthly&quot;<br />
46:       &quot;Donkey &amp; Dog&quot;
47:     </p>
48:     <p>
49:       <a href="http://validator.w3.org/check?uri=referer"><img
50:          src="http://www.w3.org/Icons/valid-xhtml10"
51:          alt="Valid XHTML 1.0 Transitional" height="31" width="88" /></a>
52:     </p>
53:   </body>
54: </html>
```

Figure 6: Source Code Listing

4. *a)* *i)* List the characteristics of *static* and *dynamic* web pages. **(3 marks)**

ii) Describe the technologies and tools used in the creation of a static web page that includes images.
(3 marks)

iii) Without repeating those elements mentioned in ii) above, describe the additional technologies and tools used in the creation of a dynamic web page. **(4 marks)**

b) *i)* `HTMLDocument`, as defined in the Document Object Model (HTML) Level 1, defines a number of attributes.

ii) List FOUR key attributes of `HTMLDocument` **(2 marks)**

iii) With reference to `HTMLDocument`, explain how you can change an image in a web page using Javascript. **(3 marks)**

c) **Figure 6** (on the previous page) details the source code of a web site for a bookshop.

i) Draw a diagram to complete the missing sections A, B and C indicated in **Figure 7** below to illustrate the output of this file when it is first loaded in a browser window. (State the browser you are assuming use of.) **(3 marks)**

iii) The links have JavaScript actions attached to them. Describe what will happen on screen in relation to user interaction with the links. **(4 marks)**

iii) The bookshop wishes to add extra details to the web page, with the same format and functionality as the current content. Write code to enable the menu group displayed in **Figure 8** overleaf to be generated and displayed. **(3 marks)**

(Note: Your answer should list only the changes and additional lines required)
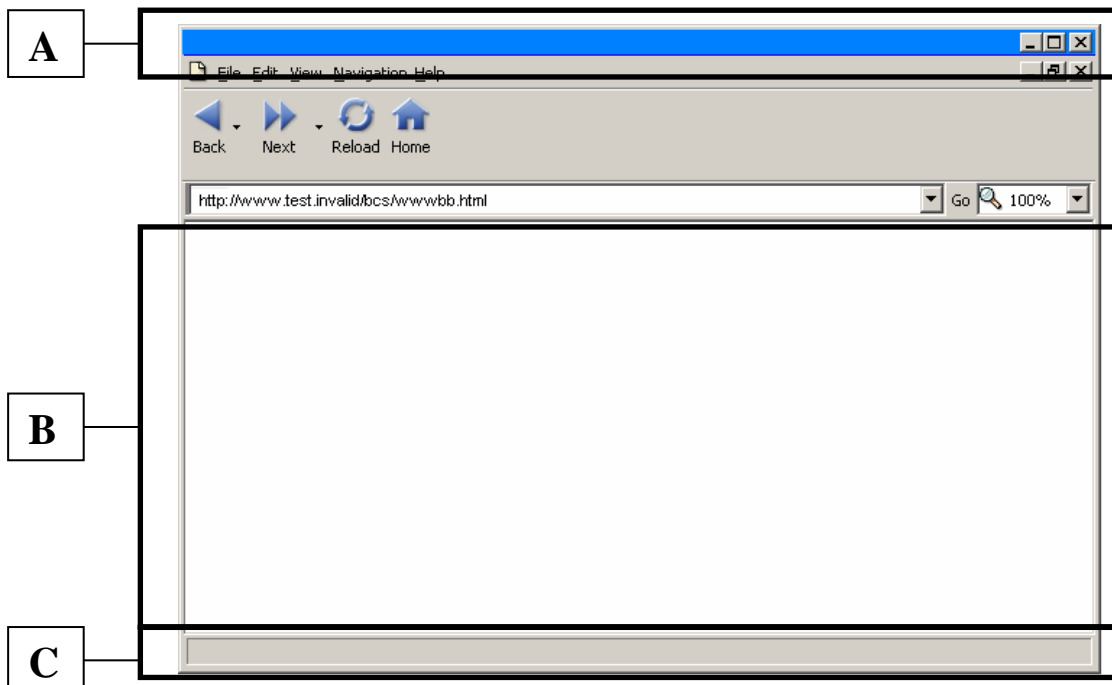
Figure 7: Template Browser Page
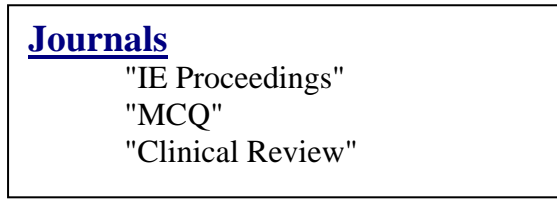
Figure 8: Menu group to add

5. *a)* *i)* With a specific example, explain what is meant by the term RSS. **(2 marks)**

    ii) What is meant by the term *podcasting*? **(2 marks)**

    iii) With reference to real life examples, explain what benefits podcasting and RSS-supported sites offer over traditional broadcasting media. **(3 marks)**

  b) *i)* Define and explain the terms *VoIP* and *IM*. **(3 marks)**

    ii) With specific reference to real-life and contemporary VoIP and IM applications, explain how internet-based real time communications have changed the way people communicate, both at work and socially **(5 marks)**

  c) Explain, with specific examples, how the WWW has transformed the way that people shop for:
    i) Music
    ii) Air travel
    ii) Financial services **(10 marks)**