

BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 6 Professional Graduate Diploma in IT

WEB ENGINEERING

Monday 23rd March - Morning

Answer **any** THREE questions out of FIVE. All questions carry equal marks.

Time: THREE hours.

Answer any **Section A** questions you attempt in **Answer Book A**

Answer any **Section B** questions you attempt in **Answer Book B**

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

Calculators are NOT allowed in this examination.

The figures referenced in this question paper are provided in a separate booklet.

Section A

Answer Section A questions in Answer Book A

- A1.** You are developing a simple web-based application to manage a collection of web bookmarks.

N.B. This question involves server-side scripting. The preferred language is PHP but answers written in ASP or JSP are also accepted. **Clearly state which server-side scripting language you will be using for the whole question**, and make sure all relevant files are named accordingly.

- a)** Web addresses are often referred to as "URL".

- i)** What does this abbreviation mean?

(1 mark)

- ii)** A typical URL takes the following format:

```
http://www.example.com/products/index.php?ref=4263&cur=gbp
```

Briefly explain what each of the following parts represent:

- http://
- www.example.com
- /products/index.php
- ?ref=4263&cur=gbp

(2 marks)

- b)** First, you will build a simple front-end in a file named bookmarkinput.html

- i)** Write HTML to construct the page as indicated in Figure 1.1.

(1 mark)

- ii) Add a simple form to your code. This form must take the following input parameters:
- a single-line string representing the location of a web page, named `address`
 - a single-line text description, named `title`

These two parameters must be sent to a script named `savebookmarks.php`. When doing so, the parameters should not be visible in the address bar of the web browser.

(3 marks)

- c) The URL entered in the `address` field might be incorrect.

- i) We wish to add some basic client-side validation to the address field. The validator should check that:
- the first part of the URL is present (`http://` or `https://`)
 - the second part contains at least one character

Write the corresponding code.

(3 marks)

- ii) If you were to write code to check the *existence* of a URL, should it be written on the client side, or on the server side? Explain why.

(1 mark)

- d) You have access to a database called `BOOKMARKMANAGER`, which contains a single table named `Bookmarks` (as shown in Figure 1.2). The database is hosted remotely at `mywebhost.com`. The administrator username is `db_admin` and the password is `foobar4263`

Using the server-side scripting language of your choice, write a function called `connectToDatabase`, which:

- takes no input parameters
- establishes an authorised connection with the database host
- gets access to the database itself
- displays relevant error messages when necessary
- returns a connection handle, to be used in future database queries

This function will be saved in a file called `myfunctions.inc`

(3 marks)

- e) You will now write the back-end of your application.

- i) In a file called `savebookmark.php`, write a function called `savebookmark`, which:
- takes 2 strings called `myAddress` and `myTitle` as an input
 - gets access to the `Bookmarks` table described earlier, by referring, via an appropriate mechanism, to the function `connectToDatabase` defined in d)
 - saves `myAddress` and `myTitle` in the `Bookmarks` table
 - returns `true` if the operation was a success, `false` if it failed

(3 marks)

- ii) Still in `savebookmark.php`, write code to:
- generate a full, valid web page entitled "Saving Bookmark"
 - check that the input parameters obtained from the form in `bookmarkinput.html` (see question b) ii)) have been set; if not, display an error message linking back to `bookmarkinput.html`
 - use the `savebookmark` function to save the input parameters in the database
 - display a relevant message regarding the success or failure of the operation

(3 marks)

- f) Write another file called `displaybookmarks.php`:
- the page should display, ordered by `id`, all the web addresses contained in the database
 - the results should appear as a HTML table
 - the first column of the table should contain the title of each bookmark
 - the second column should contain the corresponding address, formatted as a hyperlink

(5 marks)

The following SQL syntax may be useful to accomplish some of this question's tasks:

```
INSERT INTO tbl_name (col1, ...) values (val1, ...);  
SELECT * FROM tbl_name WHERE col1 = val1;
```

where `tbl_name`, `col1`, `val1` are replaced with appropriate values.

A2. In February 2014, the online auction house eBay® was the victim of an attack that compromised the details of an estimated 145 million users. Please read the press article on the attack in Figure 2.1 then answer the questions below:

- a) One possible security risk for the users of eBay® is phishing. A partial solution to this is to never follow hyperlinks to the eBay® website from an email, but instead enter the URL manually.

- i) Explain, with an example, what is meant by the term *phishing*.

(2 marks)

- ii) Aside from phishing, and the attack outlined in the article, give THREE other security risks to the users of eBay® that could result in disclosure of user data, and for each risk outline a method to prevent it.

(6 marks)

- b) It is believed that no financial or credit card data was revealed, as this information is stored separately. With reference to the information in the article, and using a suitable example to demonstrate the impact, explain how the information disclosed might still present a serious risk to affected users.

(3 marks)

[Turn Over]

- c) When the attack was discovered, eBay® asked users to change their passwords.
- i) With a suitable example, describe ONE positive consequence of this action, and ONE negative consequence of this action. (N.B. this may be considered from either the corporate or user perspective). **(2 marks)**
- ii) One alternative action that eBay® could have applied would be to disable all user accounts and ask the users to reactivate them after proving their identity.
- Explain why each of the following normal methods of account verification might not be safe:
- asking the user to confirm their current address and payment details
 - sending an activation code to the user's email address
 - confirming the maiden name of the user's mother
- (3 marks)**
- iii) Taking into account the weaknesses of the methods discussed in part c) ii) propose (with appropriate justification) a robust method of verifying the identity of a user that offers a good balance between user account safety and cost effectiveness. **(3 marks)**
- d) Initial communications from eBay® about the security compromise was made in the form of a press release on their corporate website, two weeks after discovery.
- In no more than 500 words, discuss eBay's® actions.
- In your answer, you should consider the pros and cons of both the method of communication used and the time interval between discovery and initial communication. **(6 marks)**

Section B

Answer Section B questions in Answer Book B

- B3. a) "A well formed XML document is necessarily valid". Briefly explain the correctness or otherwise of this statement. Support your answer with a suitable example. **(4 marks)**
- b) Data interchange formats between applications can be based on XML or JSON technology. Discuss the appropriateness of each, citing suitable examples. **(4 marks)**
- c) XML documents can be validated against DTDs or XML schema. Discuss the benefits and drawbacks of each approach citing suitable examples. **(4 marks)**

[Turn Over]

- d) Write an external DTD, `company.dtd` for the following XML file:
- Sequence of elements is as shown in the XML code in fig 3.1 (i.e. CompanyList is a container of Company elements)
 - The attribute Company Code is mandatory
 - Company_url is optional
 - Company_url must have a page attribute
 - For each Company, one Company_name, Company_url, Contact_name and zero or more Job_vacancy element must be present
 - For each Contact, there must be a Contact_name, Contact_phone, Contact_email
 - For each Job_vacancy, exactly one Job_title, Job_description, Job_location, Job_salary and Start_date must be present
- (13 marks)**

- B4. a)** An independent blogger has decided to publish properties for sale on her site based on data accumulated from various estate agents. She has checked that there are no copyright breaches, as she is providing a free service. She has created an XML document to hold the details of these properties; a sample is shown in fig 4.1. She wants to display these properties as shown in figure 4.2.

The properties are separated into houses and flats with details of location, image, agent, local authority and the condition of the property. The image is to also serve as a link to a photo gallery for the property. The agent name is a link to the agent's web site and the email address is to be an active link. The style sheet has already been developed including an HTML template, provided in Figure 4.3.

You are to write the code that will process the XML data and render it as a web page as shown in Figure 4.3. You are advised to show the code for the following, including appropriate comments to explain how the code will work:

- i.* The code to display all the properties by type;
- ii.* The code to display the property image;
- iii.* The code to make the displayed image into a link that will open another window where a photo gallery of the property will be displayed;
- iv.* The code to display all the agent details as shown including the agent name and the email address rendered as links.

(18 marks)

- b) A further enhancement that the blogger would like to provide is a feature for a potential buyer to make an appointment with the agent to view the property. Discuss how this could be achieved; note that you are not required to code this.
- (4 marks)**
- c) List two further enhancements that could be made to this site to make it more user friendly and fit for purpose.
- (3 marks)**

[Turn Over]

- B5.**
- a) Define and briefly describe a Web feed using a suitable example. **(2 marks)**
 - b) Define and briefly describe a Web API using a suitable example. **(3 marks)**
 - c) A Web API can be implemented using either a Representational State Transfer (REST) protocol or Simple Object Access Protocol (SOAP). Describe the workings of each of these protocols and benefits of each. **(5 marks)**
 - d) Identify the stages and issues when creating an API from a producer's viewpoint. **(5 marks)**
 - e) As a Web engineer, identify at least FIVE major challenges in the design and development of an image-hosting site, where users can upload their images to a central server and the images can be retrieved via a web link or an API. Initially, focus on two the ability to upload (write) an image to the server, and the ability to query for an image. For each of the challenges identified, provide an outline solution including the technology to be used. Your answer should be in the form of a slide presentation to the client (5 slides with bullet points). **(10 marks)**

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**FIGURES TO ACCOMPANY 2015 MARCH EXAMINATION PAPER IN
WEB ENGINEERING**

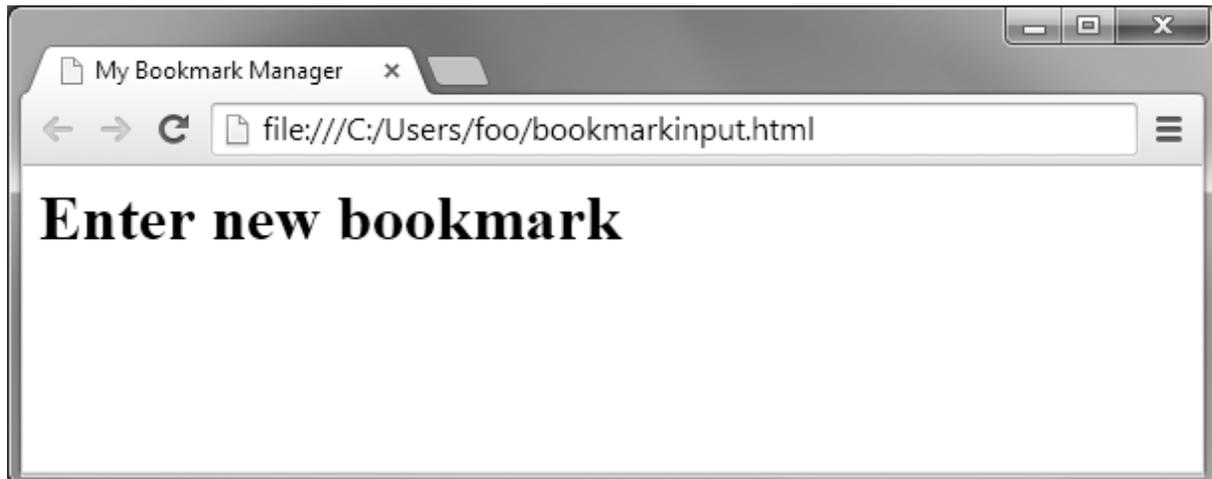


Figure 1.1 - Sample web page

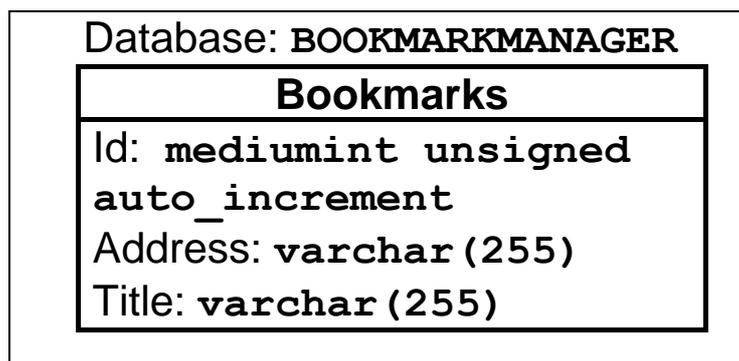


Figure 1.2 – Database Entity-Attribute diagram

eBay Inc. To Ask eBay Users To Change Passwords

eBay Inc. (Nasdaq: EBAY) said beginning later today it will be asking eBay users to change their passwords because of a cyberattack that compromised a database containing encrypted passwords and other non-financial data. After conducting extensive tests on its networks, the company said it has no evidence of the compromise resulting in unauthorized activity for eBay users, and no evidence of any unauthorized access to financial or credit card information, which is stored separately in encrypted formats. However, changing passwords is a best practice and will help enhance security for eBay users.

Information security and customer data protection are of paramount importance to eBay Inc., and eBay regrets any inconvenience or concern that this password reset may cause our customers. We know our customers trust us with their information, and we take seriously our commitment to maintaining a safe, secure and trusted global marketplace.

Cyberattackers compromised a small number of employee log-in credentials, allowing unauthorized access to eBay's corporate network, the company said. Working with law enforcement and leading security experts, the company is aggressively investigating the matter and applying the best forensics tools and practices to protect customers.

The database, which was compromised between late February and early March, included eBay customers' name, encrypted password, email address, physical address, phone number and date of birth. However, the database did not contain financial information or other confidential personal information. The company said that the compromised employee log-in credentials were first detected about two weeks ago. Extensive forensics subsequently identified the compromised eBay database, resulting in the company's announcement today.

The company said it has seen no indication of increased fraudulent account activity on eBay. The company also said it has no evidence of unauthorized access or compromises to personal or financial information for PayPal users. PayPal data is stored separately on a secure network, and all PayPal financial information is encrypted.

Beginning later today, eBay users will be notified via email, site communications and other marketing channels to change their password. In addition to asking users to change their eBay password, the company said it also is encouraging any eBay user who utilized the same password on other sites to change those passwords, too. The same password should never be used across multiple sites or accounts.

Source: eBay Corporate Website, http://www.ebayinc.com/in_the_news/story/ebay-inc-ask-ebay-users-change-passwords, published on 21st May, 2014

Figure 2.1 – eBay press release re: February 2014 attack

```

<?xml version="1.0" encoding="ISO-8859-1" standalone="no"?>
<!DOCTYPE CompanyList SYSTEM "company.dtd">

<?xml-stylesheet type="text/xsl" href="company.xsl"?>

<CompanyList>
  <Company CODE="1212">
    <Company_name>IBM</Company_name>
    <Company_url page="http://www.ibm.com"/>
    <Contact>
      <Contact_name>Bob Jones</Contact_name>
      <Contact_phone>0044112233</Contact_phone>
      <Contact_email>bjones@ibm.com</Contact_email>
    </Contact>
    <Job_vacancy>
      <Job_title>Analyst</Job_title>
      <Job_description>Design payment
systems</Job_description>
      <Job_location>London</Job_location>
      <Job_salary>£30000</Job_salary>
      <Start_date>25 June 2015</Start_date>
    </Job_vacancy>
    <Job_vacancy>
      <Job_title>Usability Engineer</Job_title>
      <Job_description>Evaluation of new
systems</Job_description>
      <Job_location>Glasgow</Job_location>
      <Job_salary>£28000</Job_salary>
      <Start_date>12 August 2015</Start_date>
    </Job_vacancy>
  </Company>

```

Figure 3.1 Sample XML

```

<?xml version="1.0" encoding="ISO-8859-1" standalone="no"?>
<!DOCTYPE cbcatalogue SYSTEM "cbcatalogue.dtd">
<?xml-stylesheet type="text/xsl" href="property.xsl"?>
<propertyList>
  <category>
    <type>Houses </type>
    <property id="H1234" year_built="1920">
      <location>Haven Green</location>
      <image src="h1.png" height="100" width="100" />
      <property_gallery page="H1234.html"/>
      <price>299000 </price>
      <agent>
        <name>
          Home Finders</name>
        <email>sales@homefinders.com</email>
        <phone>032034590</phone>
        <address>12 London Road Ealing W5 5RD</address>
        <agent_url page="http://www.homefinders.com"/>
      </agent>
      <local_authority>Ealing</local_authority>
      <condition>Excellent condition throughout, in a highly sought
location.</condition>
    </property>
    <property id="H2345" year_built="1930">
      <location>Greenford</location>
      <image src="h2.png" height="100" width="100" />
      <property_gallery page="H2345.html"/>
      <price>250000 </price>
      <agent>
        <name>
          Ealing Estates</name>
        <email>sales@ealingestates.co.uk</email>
        <phone>02088791234</phone>
        <address>55 The Broadway W7 6WX</address>
        <agent_url page="http://www.ealingestates.co.uk"/>
      </agent>
      <local_authority>Hillingdon</local_authority>
      <condition>Needs updating, ideal for DIY
enthusiaist.</condition>
    </property>
  </category>
  <category>
    <type>Flats</type>
    <property id="F1255" year_built="1960">
      <location>Perivale</location>
      <image src="f1.png" height="100" width="100" />
      <property_gallery page="F1255.html"/>
      <price>290000 </price>
      <agent>
        <name>
          Ealing Estates</name>
        <email>sales@ealingestates.co.uk</email>
        <phone>02088791234</phone>
        <address>55 The Broadway W7 6WX</address>
        <agent_url page="http://www.ealingestatets.co.uk"/>
      </agent>
      <local_authority>Brent</local_authority>
      <condition>Ideal for a couple with young children.</condition>
    </property>
  </category>
</propertyList>

```

Figure 4.1

Properties for sale

Houses					
Reference	Location	Image	Agent	Local Authority	Condition
H1234	Haven Green		Home Finders Address: 12 London Road Ealing W5 5RD email: sales@homefinders.com Phone: 032034590	Ealing	Year of build: 1920 Excellent condition throughout, in a highly sought location.
H2345	Greenford		Ealing Estates Address: 55 The Broadway W7 6WX email: sales@ealingestates.co.uk Phone: 02088791234	Hillingdon	Year of build: 1930 Needs updating, ideal for DIY enthusiast.
Flats					
Reference	Location	Image	Agent	Local Authority	Condition
F1255	Perivale		Ealing Estates Address: 55 The Broadway W7 6WX email: sales@ealingestates.co.uk Phone: 02088791234	Brent	Year of build: 1960 Ideal for a couple with young children.

Figure 4.2

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
version="1.0">
  <xsl:template match="/">
    <html>
      <head>
        <title> Properties for Sale</title>
        <link rel="stylesheet" type="text/css"
href="cbbook.css"/>
      </head>
      <body>
        <h1>Properties for sale </h1>
        <table border="1">
          <xsl:for-each select="          "> <!--
need to supply a parameter here -->
            <tr>
              <th colspan="6" align="center">
                <div class="altd" >
                  <xsl:value-of select="          "/>
<!-- need to supply a parameter here -->
                </div>
              </th>
            </tr>
            <tr bgcolor="pink">
              <th align="center">Reference</th>
              <th align="center">Location</th>
              <th align="center">Image</th>
              <th align="center">Agent</th>
              <th align="center">Local Authority</th>
              <th align="left">Condition</th>
            </tr>

            <!-- TO BE COMPLETED

            The code including the comments to go here

            -->

```

Figure 4.3