BCS THE CHARTERED INSTITUTE FOR IT

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

WEB ENGINEERING

Friday 29th March 2019 - Afternoon
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.

Section A
Answer Section A questions in Answer Book A

A1.
a) The standard ISO27000:2016 defines Information Security as the *"preservation of confidentiality, integrity and availability of information. In addition, other properties such as authenticity, accountability, non-repudiation and reliability can also be involved"*

Explain in plain language the meaning of each of the following three terms used within the definition.
- *Confidentiality*
- *Integrity*
- *Availability*

(3 marks)

b) Historically, corporate networks would consist mainly of client-side PCs connecting to internal servers over a wired network.

i) State and describe THREE server-side security risks, and for each risk outline an effective method to prevent it.

(6 marks)

ii) Many companies are now adopting a policy of "bring your own device" where employees bring their own client devices to work, rather than being provided with a standardised corporate device. Provide ONE additional <u>security</u> risk this presents and suggest an effective countermeasure to mitigate against this risk.

(2 marks)

c) The Company is developing a new service for external customers. The in-house developers have outlined three possible schemes for authenticating their users. You have been asked to comment on these from a *security* perspective (how safe the scheme will be) and from a *user's* perspective (how easy the scheme will be to use).

Proposed scheme A
- Type in your *email address*
- Type in your *password* (32 characters, alphanumeric, must include at least one capital letter, one lowercase letter, one digit and one punctuation symbol)
- Select the fifth and the sixth digits of your *PIN* (6 digits) from a drop-down list

Proposed scheme B
- Type in your *first name*
- Type in your *middle* name
- Type in your *last name*
- Type in your *age*
- Type in the name of your *first school*
- Type in the name of your *current employer/school*
- Type in your *mother's maiden name*

Proposed scheme C
- System-generated *user number* (created on registration, 11 digits long)
- Type in your *password* (comprised of two 3-letter words in lower case e.g. "catsat", sent by postal letter to the user's home address)

i) For each of the three schemes, outline a *distinct* strength and a weakness from a security point of view, and a *distinct* strength and a weakness from a usability point of view.

(6 marks)

ii) With suitable justifications against the two other alternatives, give a recommendation as to which of the three schemes is the most appropriate for adoption.

(2 marks)

iii) The company is concerned with the level of security offered by these three schemes and has suggested the use of *two factor authentication*.

Write a *short report* (maximum 500 words) explaining what two factor authentication is, how it could be used in this service, and providing a recommendation as to whether or not it should be adopted <u>as part</u> of your recommended scheme. Your answer should include security, usability and potential cost factors.

(6 marks)

A2.

You are consulting for a client who wishes to create a simple web-based application to store *new* usernames and passwords for websites, so they can access them from any web-enabled device.

a) Write HTML to construct the form as indicated in figure A2.1 (including the default values shown). When the button marked "Add New Password" is pressed, the form should submit to a script called `password.php`

(4 marks)

Figure A2. 1

b) The client finds the current design uninspiring and would like something more visually appealing. Moreover, they wish to have a coherent and consistent visual design throughout the entire site.

   i) In relation to an HTML document, explain what is meant by the term CSS.

   (1 mark)

   ii) Give TWO important reasons as to how CSS can be used to help provide *"a coherent and consistent visual design throughout the entire site."*

   (2 marks)

   iii) Using CSS, list modifications to the code to change the appearance of the site as follows:

   Page Title:
   - Black background colour
   - Right-aligned bold red text in a sans-serif font, size 2.5 *em*

   Form text labels:
   - Italic text, size 1 *em*.

   (4 marks)

c) The server has a database named PASSWORDMANAGER, with a single table named Passwords (as shown in figure A2.2). You may assume the web server and the database server are the same machine. For parts ii) and iii) below, assume that the PHP script password.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).

Database: **PASSWORDMANAGER**

Passwords
URL : **varchar(99)**
Username : **varchar(30)**
Password : **varchar(32)**

Figure A2. 2

i) Write code to connect to the server to the database.

(1 mark)

ii) Write code to store the details submitted from the form into the database, saving the password as plain text.

(3 marks)

iii) Write code to validate the password field using the following rules:
- If the password type is listed as "simple", the field must have at least six alphanumeric characters.
- If the password type is listed as "complex", the field must be at least 12 alphanumeric characters and have at least one upper case letter and one digit.
- You may use regular expressions if you wish.

(5 marks)

iv) Write code to retrieve and display (in an appropriate format) all usernames and passwords for "http://www.bcs.org", presenting an appropriate message if it does not exist. 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)

(5 marks)

A3

You are the lead website administrator and programmer for a small profit-making Social Networking site, **RiverBook+.** The site has been live for 2 years and has an active user base of around 60,000 people.

The site is broadly similar in functionality to sites existing social media platforms in that users create accounts and then connect to other users, provide a profile of who they are, upload photos/videos/sound files and can comment on the activities of their other contacts. Within the website, users can make profile information, photos and comments restricted to certain users. By default, user's pages and profiles are visible to anyone browsing the website (whether logged in or not) but are not visible on search engines. The site is available via a website, and also by using an application on the commonly used mobile platforms.

The owners of the website need your expert advice on a number of recent proposals.

a) Wikipedia defines geolocation *as "the identification or estimation of the real-world geographic location of an object, such as a radar source, mobile phone or an Internet-connected computer terminal."[1]* The management of the site have heard of this and want to know if geolocation functionality should be added to the site.

    i)   With suitable examples, outline TWO benefits of using geolocational data with the website.

(4 marks)

    ii) From a user's perspective, outline the potential risk of using geolocational data on the website.

(2 marks)

b) A manager has proposed that the basic details of users' profiles should be visible on commonly used search engines. With suitable examples, identify the pros and cons of indexing user profiles on search engines.

(3 marks)

c) The management of **RiverBook+** are concerned that the default privacy setting of user accounts might be too visible to the outside world, and wishes to make all user profiles visible only to members of the website.
The management are unsure whether the new privacy settings should 1) apply only for new users and posts, or 2) apply to all content on the website, overwriting all old privacy settings.

    i)   Using realistic examples, highlight the risks of not applying the new settings to all old content?

(3 marks)

    ii) Using realistic examples, highlight the potential drawbacks of applying the new settings to all old content and overwriting all the old settings?

(3 marks)

---

[1] Source: Wikipedia, http://en.wikipeda.org/wiki/Geolocation, Last accessed 29th January 2019

d) Your company has been approached and made a business offer for your website's user data (see figure A3.1). Your manager has asked you to consider the proposal and provide a <u>presentation</u> of the proposal in terms of potential risks and opportunities. The presentation will be made to the shareholders of the company so that they can make a decision on the offer.

In no more than 6 slides, outline the potential risks and benefits to the company from this offer, considering financial, legal and ethical considerations. Ensure you provide a solid recommendation of whether the offer should be rejected or accepted.

(10 marks)

Dear Sir/Madam,

TellySales Limited is a telemarketing company, specialising in selling high-end televisions.

We have watched with interest as your social networking platform has grown over the last few years, and are impressed with the large number of users you now have – an impressive 60,000 users worldwide.

We would like to buy the following data of all your users:
- Username
- real name
- Address
- Phone numbers
- Email addresses
- the lists of "interests" and "favourite books and films"

We want to use this data for telemarketing purposes, so that we can contact your users with special offers that might interest them. We would be willing to pay you £15,000 for this data, and an extra £1,000 per month to keep our database up to date with changes/new members.

Furthermore, we would be prepared to negotiate paying for access to user photos and "wall messages" in order to better tailor the offers we can make to your users.

Obviously, we respect the privacy of your users, and so are not asking for passwords, credit cards or any other sensitive information like that.

We look forward to hearing back from you to formalise contracts.

Kind regards,

John Rogers,
TellySales Limited.

Figure A3. 1

B4.

a) Data can be stored in child elements or in attributes as demonstrated by the example in figure B4.1. Briefly state FOUR factors to be considered when using attributes instead of child elements.

(4 marks)

```
option 1:
<booking reference="20170521" date="12/05/2017">
      <agent>M.Miles</agent>
      <client_name>Jane Doe</client_name>
      <client_email>jdoe@jmail.com</client_email>
      <advice>No changges allowed</advice>
</booking>


option 2:
<booking reference="20170521">
      <date>12/05/2017</date>
      <agent>M.Miles</agent>
      <client_name>Jane Doe</client_name>
      <client_email>jdoe@jmail.com</client_email>
      <advice>No changges allowed</advice>
</booking>


option3:
<booking reference="20170521">
      <date>
            <day>12</day>
            <month>05</month>
            <year>2017</year>
      </date>
      <agent>M.Miles</agent>
      <client_name>
            <first_name>Jane</first_name>
            <last_name>Doe</last_name>
      </client_name>
      <client_email>jdoe@jmail.com</client_email>
      <advice>No changges allowed</advice>
</booking>
```

Figure B4.1

b) A lecture presentation consists of a number of slides. A DTD for these slides could be as given in figure B4.2. It has been suggested that Element slide could be any one of the following:

```
1. <!Element slide (title | topiclist) >
2. <!Element slide (title | topiclist) * >
3. <!Element slide (title? | topiclist*) >
4. <!Element slide (title ?, topiclist*) >
5. <!Element slide (title +, | topiclist) >
```

Briefly explain each of the above options in terms of permitted numbers of titles and topics.

(5 marks)

```
<?xml version="1.0"?>
<!Doctype slide [
<!Element slide (title, topiclist)>
<!Element title (#PCDATA)>
<!Element topiclist (topic*)>
<!Element topic (#PCDATA)>
] >
```

Figure B4.2

c) Explain the use of an EMPTY element in the construction of a DTD.

(2 marks)

d) Write an external DTD for a magazine catalogue, magazine.dtd that enforces the following constraints:
- the sequence of elements is as shown in the XML code in fig B4.3
- (Note: MagazineCatalogue is a container of Magazine elements);
- the two attributes in Magazine are mandatory;
- Magazine_url and Editor_email are optional;
- Magazine_url must have a page attribute;
- for each Magazine, exactly one Magazine_title, one Editor and one Publisher element must be present;
- for each Magazine, the Article element must be present one or more times;
- for each Article, exactly one Article_title and one or more Author element must be present;
- an Author has a Name and optionally an Occupation; and
- a Name consists of both a First_name and a Last_name.

(10 marks)

```
<?xml version="1.0" encoding="ISO-8859-1" standalone="no"?>
<!DOCTYPE MagazineCatalogue SYSTEM "magazine.dtd">
<MagazineCatalogue>
      <Magazine ISBN="10104571" Issue_no="4">
      <Magazine_title>NewEconomy</Magazine_title>
      <Magazine_url page="http://www.neweconmoy.co.uk" />
      <Publisher>NewMove</Publisher>
      <Editor>Rob Hood</Editor>
      <Editor_email>rhood@newworld.com</Editor_email>
      <Article>
            <Article_title>BitCoin</Article_title>

            <Author>
                  <Name>
                        <Last_name>Max</Last_name>
                        <First_name>Carl</First_name>
                  </Name>
                  <Occupation>Economist</Occupation>
            </Author>
      </Article>
      <Article>
            <Article_title>Crowdfunding</Article_title>

            <Author>
                  <Name>
                        <Last_name>Kains</Last_name>
                        <First_name>Jon</First_name>
                  </Name>
                  <Occupation>Banker</Occupation>
            </Author>
      </Article>
      </Magazine>

      <Magazine ISBN="10104890" Issue_no="7">
      <Magazine_title>3D Technology</Magazine_title>
      <Publisher>3D Group </Publisher>
      <Editor>Sen Gupta</Editor>
      <Editor_email>sguptac@conv.com</Editor_email>
      <Article>
            <Article_title>3D Printing</Article_title>

            <Author>
                  <Name>
                        <Last_name>Baux</Last_name>
                        <First_name>Billy</First_name>
                  </Name>
                  <Occupation>Engineer</Occupation>
                  </Author>
                  <Author>
                  <Name>
                        <Last_name>Bali</Last_name>
                        <First_name>Gita</First_name>
                  </Name>
                  <Occupation>Physcist</Occupation>
            </Author>
      </Article>
      </Magazine>

</MagazineCatalogue>
```

Figure B4.3

e) The `magazine.dtd` needs to be modified to enforce the following changes. State how this can be achieved and show where the changes must take place in the DTD you have written.

    i) A cover image for each magazine that captures attributes of height, width and location of the image.

(2 marks)

    ii) To capture any images where they exist for any article with the same attributes as in i) above.

(2 marks)

B5.

a) Give two examples of when an XML document needs to be transformed into another XML document.

(2 marks)

b) Write complete XSLT code to transform the XML document shown in figure B5.1 to output the following XML :

```
<root>
        <singer>Bob Dylan</singer>
        <singer>Bonnie Tyler</singer>
</root>
```

```
▼<catalog>
  ▼<cd>
     <title>Empire Burlesque</title>
     <artist>Bob Dylan</artist>
     <country>USA</country>
     <company>Columbia</company>
     <price>10.90</price>
     <year>1985</year>
  </cd>
  ▼<cd>
     <title>Hide your heart</title>
     <artist>Bonnie Tyler</artist>
     <country>UK</country>
     <company>CBS Records</company>
     <price>9.90</price>
     <year>1988</year>
  </cd>
</catalog>
```

Figure B5. 1

(5 marks)

c) Give two examples of when it is necessary to convert XML data into JSON.Give
   JSON representation of XML data shown in figure B5.2.

(6 marks)

```xml
<?xml version="1.0"?>
<investments>
  <item type="stock" exch="nyse"   symbol="ZCXM" company="zacx corp"
        price="28.875"/>
  <item type="stock" exch="nasdaq" symbol="ZFFX" company="zaffymat inc"
        price="92.250"/>
  <item type="stock" exch="nasdaq" symbol="ZYSZ" company="zysmergy inc"
        price="20.313"/>
</investments>
```

Figure B5. 2

d) Write complete XSLT code to render the XML data shown in figure B5.3 to render it
   as shown in figure B5.4.

(6 marks)

```xml
<sales>
  <products>
    <product id="p1">Packing Boxes</product>
    <product id="p2">Packing Tape</product>
  </products>
  <record>
    <cust num="C1001">
      <prodsale idref="p1">100</prodsale>
      <prodsale idref="p2">200</prodsale>
    </cust>
    <cust num="C1002">
      <prodsale idref="p2">50</prodsale>
    </cust>
    <cust num="C1003">
      <prodsale idref="p1">75</prodsale>
      <prodsale idref="p2">15</prodsale>
    </cust>
  </record>
</sales>
```

Figure B5. 3

Product Sales Summary

	Packing Boxes	Packing Tape
C1001	100	200
C1002		50
C1003	75	15
Totals:	*175*	*265*

Figure B5. 4

e) Write complete XSLT code to render the XML data shown in figure B5.3 to render it as shown in figure B5.5.

(6 marks)

Record of Sales

- C1001 - Packing Boxes - 100
- C1001 - Packing Tape - 200
- C1002 - Packing Tape - 50
- C1003 - Packing Boxes - 75
- C1003 - Packing Tape - 15

Figure B5. 5

END OF EXAMINATION PAPER