THE BCS PROFESSIONAL EXAMINATION
Professional Graduate Diploma

April 2007

EXAMINERS' REPORT

The World Wide Web – Beyond the Basics

General Comments

This was the fifth time the paper was offered and it is in the process of being superseded by the paper Web Engineering (which was offered for the first time in April 2007). As in previous years, the general standard ranged from barely coherent to excellent.

A common failing this year was to quote verbatim the answer pointers from similar questions in previous years. It should be noted that these answer pointers are not full answers, but instead outline points to guide candidates in answering. The nature of these questions is such that "memorising" answers and quoting them verbatim in the examination does not carry much weight. Also of note is that whilst questions may be on similar topics to past papers, the emphasis is often entirely different, and it is important to read and answer the questions carefully and in context.

Recurring issues from previous years:

1. Writing too much: Whilst this is improving, many candidates still write far too much often taking two or more pages to make a simple point worth very few marks.
2. Handwriting: Again, whilst this is improving as well, handwriting Is still an issue in some cases.
3. Textbook theory: The answers continue to be very heavy in textbook theory and not sufficiently contextualised. Answers must refer to real life issues, events and topics when asked.

Question 1

There are a number of categories of files that make up a website. One example would be image files (JPEG, GIF, PNG etc.).

a) List, with an example, **FIVE** other distinct categories of files that can be used within a website **(7 marks)**

b) *Define* and *explain* 5 different aspects by which a single web ***page*** can be evaluated and tested. **(8 marks)**

c) Given a B2C website (e.g. `http://www.amazon.com`), explain how the entire website can be evaluated from a user's perspective. **(10 marks)**

Answer Pointers

a)

- Static Web pages (HTML)
- Dynamic Web Pages (PHP, Perl, ASP)
- Sound (Wav, Midi, mp3, OGG, WMA)
- Video (Mpeg, Avi, WMV, Mov)
- Included Scripts (CSS, Javascript, VBScript)
- Embedded Multimedia (Java Applets, SWF, DCR)
- External Document formats (Word, Excel, PDF, PPT
- Archives (Zip, SIT, RAR, tar)

b)

For full marks the answer should identify a aspect for testing, along with a *brief* rationale of why the aspect is important to consider. Some relevant aspects include:

- Spelling and grammar
- Accuracy of information
- Links (dead \links)
- Image loading time

- Time to download
- Text size, colours, contrast, etc.
- Currency of information
- Whether it loads correctly under different browsers/OS

c)

This answer should draw up a coherent test plan from the user's point of view. The test plan should involve well-formed and measurable criteria.
A well formed test plan would be expected to put the following six characteristics into the context of web sites:

- Functionality
- Reliability
- Usability
- Efficiency
- Portability
- Maintainability

As a suggestion the plan might perhaps including the following (listed below for all three):

USER TESTS
Navigation – no dead ends, etc
Consistency – colour, font
Security of transactions
Reliability
Interaction – error messages
Currency of content (age)

Examiners' Guidance Notes

This was a very popular question, attempted by 80% of candidates.
Part a): Many candidates failing to systematically identify the various categories and cite an example, instead approaching the part in an ad-hoc fashion. Often the file types were given which were just a replication of an existing category (e.g. JPG, GIF, PNG, when all are image formats).
Part b): Many candidates re-stated answers from a similar past exam question on the evaluation and testing of a website. However, in this question it was specific to a web page – an entirely different scope of test. A lot of emphasis was put on performance issues such as load testing and stress testing which would not usually be undertaken for a single page.
Part c): Many candidates again restated the answers from a similar past exam question covering users, developers and owners, whilst this year the focus was on only the user perspective and usability. There was a tendency to specify what the site should provide rather than how to evaluate from a user perspective.

Question 2

a) In relation to *internal* website navigation structures:
   i) List and explain FOUR characteristics of good navigational architectures. **(4 marks)**
   ii) Define and explain the term *breadcrumb navigation.* **(2 marks)**
   iii) Compare and contrast breadcrumb navigation with global links. Where it would be appropriate for a website comprising many distinct pages to use each? **(4 marks)**

b) "Cameras 4 U" is a retailer specialising in mid-range digital cameras. Their website advertises digital cameras and allows visitors to view a page listing all relevant cameras available by:
   - Manufacturer (Sony, Canon, Fuji)
   - Number of megapixels (0-3.0, 3.1-6.0, 6.1+)

   i) Provide an appropriately labelled diagram and brief (1 paragraph) rationale for an efficient website navigation scheme based solely on:
      - Hierarchical navigation **(5 marks)**
      - Matrix navigation **(5 marks)**

      You may add any additional link pages as required.
   ii) With appropriate justifications, explain which of these schemes (hierarchical or matrix) is the most appropriate for this brief. **(5 marks)**

Answer pointers

(a)

i)

- Establishing a definite home page
- Providing a clear paths to your destinations
- Providing routes back home.
- Use of meaningful icons and text.
- Clarity of navigation.
- Consistency of navigation.
- Adherence to "conventions"
- Absence of broken links.

ii) Breadcrumb navigation is the recording of either the location or history of the current browsing session, allowing users to immediately jump back to any position in the trail.

iii)

Global links allows access to main sections of a site from any page.
Breadcrumb navigation only allows access to those sections specifically in the trail.
Global links only allow access to those elements defined as global.
Breadcrumbs allow users to immediately jump back to any position in the trail.

Examiners' Guidance Notes

Two-fifths of candidates provided answers to this question.

Part a):

i) Most candidates answered this with some degree of success, although there was a tendency to repeat characteristics.

ii) Most of the candidates who attempted this question demonstrated a lack of familiarity with breadcrumb navigation and as such the answers were often totally unrelated to the context of this question.

iii) Many candidates were unable to compare - let alone contrast - the two navigational schemes due to lack of knowledge of each scheme. Global links were interpreted as external links when it was stated clearly that this question was about the internal website navigation structure.

Part b):

i) Most candidates had a good idea of a hierarchical navigation structure and were able to apply this navigation scheme to the question. Matrix structure was understood in theory but the application to the question was weak.

ii) Most candidates were able to justify their choice appropriately.

Question 3

Explain, with a suitable realistic example in each case, what is meant by:

a)
   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. **(10 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)**

Answer pointers

(a)

i) A denial of service attack causes a loss of services (typically network services) to legitimate users. E.g. Attack on Microsoft.com (2003).

ii) One potential defintion, as referenced from Microsoft.com at http://www.microsoft.com/technet/archive/security/news/crssite.mspx : *"Cross-Site Scripting would potentially enable a malicious user to introduce executable code of his choice into another user's web session. Once the code was running, it could take a wide range of actions, from monitoring the user's web session and forwarding a copy to the malicious user, to changing what's displayed on the user's screen. Even more seriously, the script could make itself persistent, so that the next time the user returned to the web site, the malicious user's script would start running again."*

iii) A buffer overrun (or buffer overflow) vulnerability occurs when a program writes data beyond the allocated end of a buffer in memory, potentially overwriting existing code. This may lead to the program executing arbitrary code. E.g. The Morris Worm (1988), Code Red (2001).

(b) Again, many different risks:

Client-end:

- Hardware Keylogging – Maintain physical security
- Trojaned software - run up-to-date virus checker, or Tripwire
- Forged Emails e.g. as recently pretending to be from Barclays or Microsoft – Common sense

Network:

- Sniffing – Encryption, detection of "sniffers"
- Retransmission – Encryption with timestamping or unique IDs
- Spoofing/Masquerading – Host authentication (perhaps by Public Key)
- Man-in-the-middle – as above

Server-end:

- Server compromise (leading to database disclosure) – authentication, keeping software up-to-date, regular password changing, minimum access privileges, logs, intrusion detection, firewalling, port sentry etc.
- Trojan – Virus checking, port scanning of self

(c) Risks include:

- All conventional attacks with the added disadvantage that there is no need to physically access network cabling
- "Warchalking" to discover wireless hotspots
- Connecting to networks without authorisation
- Monitoring wireless traffic

Possible solutions:

- MAC authentication
- Hiding SSID of access point
- WEP/WPA encryption (but be aware of limitations)
- Wireless "honeypots" to catch abusers
- Physical Security

Examiners' Guidance Notes

Another very popular question attempted by four-fifths of the candidates.

Part a):

i) Generally well-answered.

ii) Only very few candidates were familiar with the XSS attack, many considering it to be "hacking the scripts on a server."

iii) Typically candidates confused the buffer overrun attack with a Denial of Service attack.

Part b): This was poorly answered; Candidates restated answers from a similar past exam question, but unlike previous years, this question did not ask for risks and solutions but instead risks and the consequences of a successful attack; a very different aspect.

Part c): Reasonably well answered, but many candidates still show little familiarity with wireless networking and so were unable to answer this part. Solutions were often quoted verbatim from answer pointers of previous years, which does not give a candidate the opportunity to demonstrate their knowledge in anything more than a superficial form.

Question 4

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. [5 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

iii) Financial Services **(10 marks)**

Answer pointers

a)

i) Really Simple Syndication (or equally, Rich Site Summary or RDF Site Summary) - a family of XML file formats for Web syndication. E.g. RSS feed on BBC News to give up-to-date summaries.

ii) Podcasting is a method of distributing multimedia files (generally audio files), mainly geared for some form of personal audio player (PC, mp3 player, etc.) over the Internet using syndication mechanisms such as RSS. An example would be the use of Podcasting by Professor John Fothergill at the University of Leicester, the New Scientist podcast, etc.

iii) Any sensible reason will be considered that compares podcasting with traditional media (radio, TV, magazines, papers, etc), but as an example consider e.g. as from http://spinfluencer.blogspot.com/2006/04/benefits-of-podcasting.html

- *"Allows listeners to time-shift and place-shift media consumption*
- *100% efficiency, since episodes are only downloaded by listeners on an opt-in basis*
- *Easily accessible to a global audience that is not defined by geographic boundaries*
- *Access to an educated, influential audience with a high disposable income*
- *Ability to leverage electronic programming without an outside news media filter*
- *Most cost effective electronic media distribution channel available"*

b)

i) Any sensible reason will be considered that compares podcasting withVoIP (Voice over Internet Protocol) is the routing of voice (rather than "data") over an IP-based internet such as the Internet.

ii) IM (Instant messaging) is the name given to a suite of applications based on IRC ideas that allow fast point-to-point messaging, usually between 2 people, but with the possibility for group communication.The discussion should make reference to the benefits of VoIP and other instant communication methods over and beyond emails and other communication methods e.g.

- Real time group communications/remote meetings.
- Location of offices becomes less important (e.g. communicating Internationally).
- "Free" calls using VoIP from computer to computer.
- Videoconferencing using web cams.
- Reference to related issues such as the use of real time communications over PDAs (e.g. Contact 3.0 for explorers) will be considered.

Reference to real life IM providers (e.g. ICQ, AIM, MSN) and VoIP providers (e.g. Skype) are required for full marks.

c)

i) Aside from the general issues of global market etc, the discussion should make reference to the advent of mp3 and file distribution networks, commercial ventures such as Napster and iTunes, ordering CDs from abroad (e.g. from Play 247), and marketing and releasing of material direct from artist (e.g. mp3.com).

ii) The discussion here should look at the concept of e-ticketing, booking actual seats (instead of a general reservation), checking in and confirming online, and broker sites like expedia.co.uk.

iii) The discussion here should mention subscription-based web access e.g. credit reports, access to journal articles, support contracts over the web, topping-up of mobile phone credit, transport (e.g. oyster) with online purchase and renewal.

Examiners' Guidance Notes

Just over half of the candidates attempted this question.

Part a):

i) Generally well answered.

ii) Generally well answered.

iii) Those who understood the idea of pod-casting were able to answer this question exceptionally well, whilst those that did not typically did not attempt this part.

Part b):

i) Generally well answered.

ii) Reasonably answered from a work perspective, but the coverage of social aspects were much weaker.

Part c):

i) Generally well answered.

ii) Candidates did not show much familiarity with using WWW to purchase air travel, except for checking timetables online.

iii) Poorly answered. Students discussed the use of the WWW to check bank balances or transfer money; this is not relevant to the question of shopping for financial services.

Question 5

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

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

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

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

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

c) Figure 1 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 2 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)**

ii) 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 3 (overleaf) to be generated and displayed. **(3 marks)**

(Note: Your answer should list only the changes and additional lines required)

Answer pointers

a)

i) A static web page has the following characteristics:

- Interaction only through traversing hyperlinks or through plugins.
- Information controlled by the website creator.
- No ability to configure the presentational aspects of the site, except at a local browser level.

A dynamic page tends to have at least some of the following characteristics:

- Can respond to input data provided by the web browser when retrieving the page.
- Can alter or customise the output based on certain factors or criteria.
- Can obtain information from external sources e.g. databases.
- Can be transaction based

ii)

Static development tools and technologies include:

- Web page editor (either a standard text editor e.g. Notepad, or a WYSIWYG editor, e.g. Dreamweaver) for writing HTML.
- Image acquisition and manipulation tools e.g. Scanner, Photoshop
- File transfer software (such as FTP - possibly butlt into the web page editor)
- Web server (e.g. Apache)

iii)

Dynamic development tools and technologies include:

- Scripting languages (e.g. PHP, ASP, JSP, Coldfusion, Perl)
- Possbily development tools/IDE for the dynamic language (e.g. Coldfusion, NetBeans).
- Web server supporting the chosen dynamic languages

b)

i)

DOM:

- title
- referrer

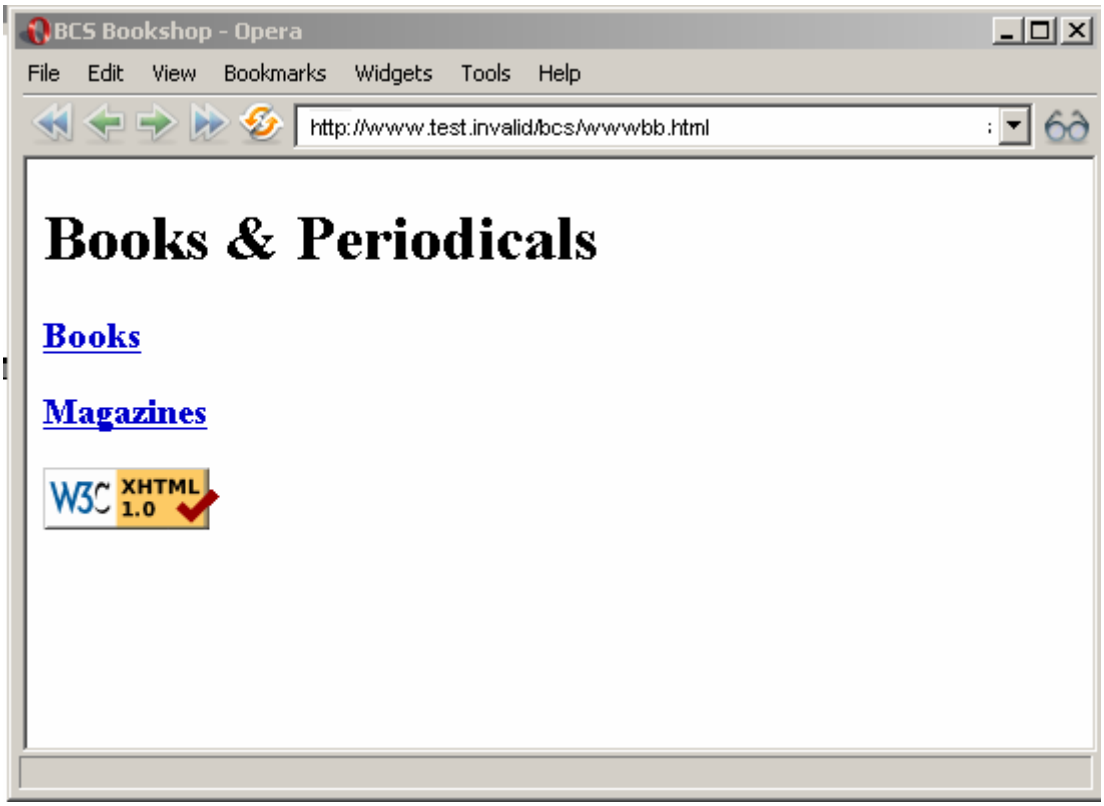
- domain
- URL
- body
- images
- anchors
- links
- forms
- applets
- cookie

ii)

document.images[whatever].src = “http://new_image_url”

c)

i)



ii)

When the user clicks a link, the related menu group is displayed.
If the mouse is clicked on the link a second time, the menu is made invisible.

The menu groups are displayed and made invisible independently of each other.

iii)

Add the following code after line 47:

```
<h3><a href="page3.html" onmouseover="return togglegroup('group3')">
    Journals</a></h3>
<p id="group3" class="group">
    IE Proceedings<br />
    MCQ<br />
    Clinical Review
</p>
```

Examiners' Guidance Notes

Just under half of the candidates attempted this question.

Part a): Most candidates answered this appropriately, however the good candidates clearly demonstrated the technologies and the respective tools within those technologies. There were a number of candidates who failed to structure their answers.

Part b):

i) A number of candidates failed to understand that the question was about DOM and interpreted it as though it was about basic HTML which resulted in answers discussing and demonstrating HTML tags.

ii) A number of candidates went onto write JavaScript functions to enable image swap when in fact it was simply asking about JavaScript action with a DOM reference.

Part c): Again, quoting from past exam papers was the downfall of many candidates here; the two menu items operated independently and the action was triggered with a mouse click as opposed to being linked and triggered on a mouse over.