THE BCS PROFESSIONAL EXAMINATION
Diploma

April 2004

EXAMINERS' REPORT

The Internet & World Wide Web

General
This paper required the candidate to attempt four questions from a choice of six. The quality of answers ranged from very poor to very good. Many candidates showed poor exam technique; problems included illegible handwriting and a failure to communicate in a concise and coherent manner. Frequently, candidates wrote several pages for a question worth two marks.

Question 1
a) Define the terms *HTML, tag* and *hyperlink* **(6 marks)**

b) Why are standards important for HTML? **(6 marks)**

c) How are standards established for HTML? **(5 marks)**

d) Explain using some sample HTML tags, the basic structure of a simple web page. **(8 marks)**

Examiner's Comments
Most students correctly defined *HTML* but many struggled with *tag* and *hyperlink*. Few were able to give a coherent argument for why standards are important and many had no idea how standards are established. A surprisingly high number of candidates could not give a correct structure for a simple web page

Answer Pointers
(a) HTML - hypertext markup language
Tag – Instructions to the browser enclosed in <>
Hyperlink – a link to another resource in hyperspace e.g. a pointer to a document on another web site

(b) Browser developers rely upon the HTML standard to program the software that formats and displays HTML documents. Authors use the standards to make sure they are writing effective, correct HTML documents.   If standards are not adhered to then different browsers will display documents in different ways – the best viewed with IE X syndrome.

(c) The World Wide Web Consortium (W3C) is the organisation responsible for drafting, circulating for review and modifying the standards. In practise, browser suppliers often implement their own extensions to the standards, which often become part of the next standard.

The page is opened the <HTML> tag and closed with </HTML> tag. It normally consists of a head <HEAD> and <BODY>. The <HEAD> may contain elements such as <TITLE>. The body contains the heart of the page and will include text image and hyperlink tags

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<HTML>
<HEAD>
<TITLE> A simple page</TITLE>
</HEAD>
<BODY>
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```
            Tags such as <P> <IMG> <A HREF..> here
    </BODY>
    </HTML>
```

Question 2

A minor celebrity has approached you to produce a web site for her fan club. Having seen other such sites, she has ambitious ideas for her own site. Apart from the usual biographical information, which is text and image based, she would like her fans to be able to download audio and video clips of her recent concert tour. Initially these would be free, but ultimately she would like to be able to take payment for these as well as the usual mugs and t shirts. Unfortunately, her budget is limited and therefore she has decided to phase the development of her site.

a) How would you advise her to phase the development of her site?   **(4 marks)**
b) What are the key stages in the production of her site?   **(7 marks)**
c) What software tools would be used in the development of the site and what would they be used for?
                                                                                    (7 marks)
d) What are the principle design issues associated with the site?   **(7 marks)**

Examiner's Comments

Many candidates struggled to answer this question adequately. The question contained a number of clues to the site phasing but many candidates ignored them and wrote about the development life cycles. They then repeated what they had already written for part (b). The term "software tools" was poorly understood e.g. HTML and .jpg were frequently given as examples. The question asked about development tools but many students discussed end user software such as Real Player. The final part was interpreted as a checklist of all the development issues rather than the principle design issues.

Answer Pointers

(a) Initial site – simple site composed largely of text and images. Various low cost hosting options assuming limited bandwidth. If the site becomes popular (as her star rises), then she may need to consider more expensive hosting options.
Interim stage – expand to include the audio and video clips. Bandwidth is obviously as issue and she might consider streaming.
Advanced stage – charging for downloads requires more processing and has the usual e – commerce implications e.g. security, links to 3rd party sites for the credit card handling etc.

(b) Whilst much web site development is done ad hoc there are various stages that are common:
- Requirements analysis
- Storyboarding and design
- Coding
- Testing
- Maintenance

(c)

Tool	Use	Example
Authoring /Text Editor	Preparation of HTML code	Dreamweaver /Notepad
Image Manipulation	Preparation of images	Photoshop
Video Manipulation	Preparation of video clips	Premiere
FTP	Uploading site to server	FTP client/Authoring tool
Encoding	Encoding video for streaming	Real Encoder

(d) Design issues could include:
- Look and feel of the site – the metaphor
- Use of colour, font, styles.
- Navigation
- Target platforms, browsers and users

Question 3
a)   Define the acronym DNS.   **(2 marks)**
b)   Explain the purpose of DNS.   **(5 marks)**
c)   Why do users frequently experience DNS lookup errors?   **(8 marks)**
d)   Compare and contrast dialup and broadband as Internet connection methods.   **(10 marks)**

Examiner's Comments
Most candidates quoted address translation but many confused DNS servers with DHCP servers. Few demonstrated good understanding of how it worked which led to some bizarre answers to the lookup error question e.g. website off-line, not enough IP addresses etc. The final part should have been straightforward but many candidates wrote far too much about how dial up and broadband work, rather than comparing and contrasting them.

Answer Pointers
(a) DNS is domain name server/system

(b) These are computers on the Internet which perform the address translation from IP to the more common addresses such as www.bcs.org.uk. These allow the Internet to function without the need for people to remember IP addresses such as 193.62.2.34

(c) The web browser sends a request to its DNS server to lookup an IP address. The DNS server maintains a database of DNS entries based on location and frequency of request. Given the number of possible DNS entries, it is not exhaustive and therefore sometimes it needs to pass on the request to another DNS server higher up the hierarchy. This can take time and therefore the browser request may timeout before the answer is returned. The timeout generates the error message. The repeat request is often successful, as much of the search has been completed. Caching also aids the process.

(d)

Attribute	Dialup	Broadband
Speed	Relatively slow	Fast
Connection time	Requires negotiation for each connection	Always on
Bandwidth	Narrow	Wide
Cost	Cheap	More expensive
Convenience	Ties up phone line	Can make calls whilst online

Question 4

You have been employed as a freelance designer for a web authoring company that has been contracted to produce a cinema web site. The site will have a main booking page that allows customers to view film information and purchase tickets online by people accessing the site from home.

a) Provide an initial design sketch that could be used to produce a **prototype** for the main booking page of the site.
(7 marks)

b) Briefly describe the **design** you have produced, explaining the design decisions made. **(8 marks)**

c) List the different technologies and languages that would be involved in **producing** the main booking page you have designed and describe the role they would play in your design. **(10 marks)**

Examiner's Comments

Only a few candidates answered this question very well. Some candidates, despite being asked to design the booking page, provided a sketch of the main page of the cinema site. Also candidates had a limited capability to justify their design through the application of good Human Computer Interaction and design best practice, describing how the user would go through the process rather than how the interface would facilitate this. Finally candidates presented only a basic understanding of the technologies that would need to be applied to produce the designed page.

Answer Pointers

a)   The answer should provide a suitable design sketch exhibiting good information and interface design characteristics.   (7 marks)

b)   The answer should show an understanding of the positive characteristics exhibited by the sketch produced in part (a) – e.g. use of: affordance, metaphors, layout, feedback, navigation, etc.   (8 marks)

c)   The answer should show understanding of the technologies that would need to be applied to produce the designed page. For example:
- HTML (forms, tables, etc.): Basic layout
- Stylesheets: Advanced layout
- JavaScript: Data entry validation and dynamic interface components
- DBMS: Background data management
- Flash: Multimedia content and user interaction   (10 marks)

Question 5

a) Define the terms *client application* and *server application* and their associated characteristics. Furthermore describe how they interact with each other. **(12 marks)**

b) There are various hosting options available to organisations. Three of the available options are: Shared Hosting Environments, Dedicated Servers and Collocated Servers. Define what each of these three types is and differentiate between them. **(13 marks)**

Examiner's Comments

Whilst the majority of candidates were able to present a basic understanding of clients and servers, a significant number of candidates were not able to correctly define and differentiate between the three hosting options of Shared Hosting Environments, Dedicated Servers and Collocated Servers.

Answer Pointers

a) The answer should approximate to:

CLIENT refers to the application that actively initiates contact. *SERVER* refers to the application that passively awaits for contact.

Characteristics of a Client Application:
- is an arbitrary application program that becomes a client temporarily when remote access is needed, but performs other computation locally
- is invoked directly by a user, and executes only for one session
- runs locally on a user's PC
- actively initiates contact with a server
- can access multiple services as needed, but actively contacts one remote server at a time
- does not require special hardware or a sophisticated operating system on them.

Characteristics of a Server Application:

- is a special-purpose, privileged program dedicated to providing one service, but can handle multiple remote clients at the same time
- is invoked automatically when a system boots, and continues to execute through many sessions
- runs on a shared computer
- waits passively for contact from arbitrary remote clients
- accepts contact from arbitrary clients, but offers a single service
- requires powerful hardware and a sophisticated operating system.

Information flows both directions between a client and a server. Typically a client sends a request to the server, and the server returns a response to the client. In some cases, the server provides continuous output without any request. (e.g. In digital video streaming)

(2 marks each for definition & maximum 3 marks for characteristics for each; 2 marks for how they interact)   (Total 12 marks)

b) The answer should approximate to:

Shared Hosting Environment: A shared environment means that a hosting company uses shared resources (servers, switches, routers, etc.) to host several web sites. A single server can handle many small web sites. A shared hosting environment is best for small business owners and or personal web sites. In most cases the cost is less than £20.00 per month and gives you access to email, web stats and most things a small business will need online. The downside is usually the amount of hard disk space each site is given and the amount of bandwidth each site is allocated.

Shared environments are not usually meant for web sites with huge traffic numbers. If the company plans on 50,000 people accessing their web site each month, this will probably crash a shared server. However, this is not always the case as some web hosting companies implement additional technologies to enable their shared hosting platform to handle extreme demands without being overwhelmed by the traffic. These technologies include: load balanced server farms;

server farms that are dedicated to handle either mail, web traffic or parked domains; RAID-5 data storage, etc.

Load balancing effectively distributes the demand for resources across a system so that no single part of the system is doing more than its' fair share of the workload. Multiple server farms serve to handle specific tasks like mail or web pages instead of having these services reside within a single server farm or ever worse, on a single server. RAID-5 data storage is an advanced technology that senses a hard drive failure and brings a back-up drive online to seamlessly replace the malfunctioning device.

Dedicated Servers: A dedicated server is a single computer fully devoted to the needs of one customer. They allow for faster access to information and provide greater flexibility in software, site traffic management, and scalability. Mid to large size companies for example who stream large amounts of video or audio also use dedicated machines as the bandwidth necessary to accommodate these streams is usually greater than a shared streaming server can handle. This type of hosting is growing in size, as companies realise the need to outsource the hardware management, as well as the hosting environment. This reduces the overall cost of hosting, by eliminating large up-front capital investments in equipment. Everyone that has been involved in hosting for any period of time can understand the financial pain in buying equipment that is quickly out dated.

Dedicated servers allow companies to have the greatest amount of flexibility for change. This is true both in growth periods and when a company might need to scale back. In most cases these services are on a month-to-month contract. With dedicated servers, customers are able to have root access to their servers, given them complete control of the network.

Collocated Servers: If a company is committed to doing business on the Internet, sooner or later they have to face important decisions. Where do they locate their server if they plan on owning it as opposed to leasing a server? Who manages their Internet operations? Collocated servers outsource the management and day-to-day operations of a company's servers by placing them in a secured environment with regulated power, dedicated Internet connection, security and fire detection/suppression. In addition to this, the company is be able to remotely monitor their connection, power cycle individual servers and track their bandwidth usage. Most companies that use collocation for hosting, have already made significant investments into hardware, or need to physical access their servers on a daily or weekly basis. Another advantage to using collocation hosting, can be the ability to create a WAN connection from rack space back to the customer's office. This can reduce the costs of the companies Internet needs, and create a private connection to the hosted servers.

(Up to 4 marks each for definition and differentiation – bonus 1 mark for correctly defining and differentiating between all three types of hosting option.)   (Total 13 marks)

Question 6
Use of e-mail as a communications medium is now prolific.

a) The there main paradigms for accessing messages are offline operation, online operation and disconnected operation. Differentiate between these three types.   **(6 marks)**

b) Define the term MIME and describe what benefits it provides for e-mail services.   **(9 marks)**

c) POP3 and IMAP are two methods of receiving mail. Briefly define the two terms describe what features are common between them and what differentiates them.   **(10 marks)**

Some candidates were confused between the differences between offline and disconnected operation. For those candidates who knew what MIME was, they answered this part of the question reasonably well, however it is evident that some are completely unaware of what MIME is and what it offers. Finally the majority of candidates were able to present a basic understanding of POP3 and IMAP. However some were confused between the functionality offered and attributed some aspects of functionality to the other method.

Answer Pointers

a) The answer should approximate to:

> Offline operation
> - Mail client (Mail User Agent) periodically interrogates server
> - Server downloads to client machine
> - Message processing local to client machine
>
> Online operation
> - Mail client remotely manipulates mail on server
>
> Disconnected operation
> - Mail client interrogates server and makes cache copy of selected messages
> - Mail client disconnects from server
> - User operates on message cache "offline"
> - Mail client reconnects to server and synchronizes - primary copies on server
>
>   (2 marks per type – Total 6 marks)

b) The answer should approximate to:

MIME stands for **M**ulti-part **I**nternet **M**ail **E**xtensions. It is flexible, robust and cross-platform. For this reason MIME has become the dominant standard for mail attachments.

Benefits of MIME are that it:
- encodes attachments in a very robust way so that they can be passed intact between many different types of computer and operating system;
- attempts to describe what sort of file the attachment is, so that you know which software you require to read the file;
- allows multiple attachments to be included in one mail message. These can either be different files, or the same file saved in different formats to maximise the chances of the recipient being able to read it.
        (3 marks for definition and 2 marks per benefit for maximum of 6 marks - Total 9 marks)

c) The answer should approximate to:

- POP3 – Post Office Protocol Version 3
- IMAP - Internet Message Access Protocol / Internet Mail Access Protocol
                          (1 mark each for correct definition of protocol – 2 marks)

> Common Features
> - Client and Server Components
> - Store mail on server
> - Support for MIME (max 2 marks for common features – 2 marks)
>
> POP3 - An offline protocol
> - Downloads/duplicates all mail to client
> - Simple and easy to implement
> - Only works well if user only ever works on one machine

IMAP - An online/disconnected protocol
- Stores mail on server
- Can selectively download mail to client
- Works well if user accesses mail from a variety of different machines

(max 3 marks per protocol for differences – 6 marks)

(Total 10 marks)