THE BCS PROFESSIONAL EXAMINATION
Diploma

April 2003

EXAMINERS' REPORT

The Internet & World Wide Web

General

This subject was examined for the first time this year and it proved to be popular with candidates. The general standard ranged from outstandingly good to barely coherent. A significant group of students wrote far too much often taking two or more pages to make a simple point worth two or three marks. Coherency was lacking in a number of papers with repetition and deviation from the answer.

1. (i) Define and explain the terms Internet and World Wide Web. (10 marks)

(ii) For many people, the Internet has become the World Wide Web. Highlight the reasons for this confusion and explain why they are not identical concepts. (15 marks)

Answer Pointers

(a) The candidate would be expected to define the Internet using terms such as "global", "network", "interconnection", "infrastructure" giving access to "shared" "resources". The World Wide Web is a method of using the Internet to share and distribute multimedia-enabled, electronic documents using hypertext linking. (10 marks)

(b) Many people only browse the Web and are thus unaware of other applications of the Internet. Even if they use email, it frequently appears as another web application (web mail) or the email client is part of their web browser. Strictly, the Internet is the network infrastructure and the Web is an application which runs on it. (15 marks)

Examiner's Guidance Notes

This was a very popular question answered by nearly all candidates. A worryingly large number of candidates were incapable of differentiating between the Internet and the WWW. Few supported their answers with any technical detail.

2. (a) Define and explain the term URL using a suitable example. (5 marks)

(b) Compare and contrast the benefits and drawbacks of fixed and dynamic IP addressing. (10 marks)

(c) Explain the role of the HTTP protocol when a user requests and is served a web page. (10 marks)

Answer Pointers

(a) Uniform Resource Locator made up of protocol, server name, port and path and file name. It is the address on the Internet, e.g. http://www.bcs.org.uk/examiners/examhints.html (5 marks)

(b)

Fixed		Dynamic	
Advantage	Disadvantage	Advantage	Disadvantage
Doesn't change so suitable for servers where their IP address needs to be known	Allocates addresses to computers which may not even be connected therefore wasteful	Allows a pool of addresses to be allocated to computers only when they are needed e.g. dialup connections. More efficient	Address changes each time and therefore is unsuitable for servers
No reliance on a DHCP server	Harder to manage and mistakes may result in clashes between two computers inadvertently given the same address	Easier to manage through a DHCP server	Dependency on DHCP server. If it fails, then computers will be unable to connect

(10 marks)

(c) Client web browser issues an HTTP GET command which includes the URL of the resource required and details of the requestor including return address. Server interprets the GET and returns the requested resource. This may be a file including HTML or it may be the output of a program on the server.

(10 marks)

Examiner's Guidance Notes

This was another popular question. Most candidates defined and gave examples of URLs based on the web and few included the port. In general, the benefits and drawbacks of fixed and dynamic addressing were poorly understood. Many confused 'http' with TCP/IP and few students referred to the 'get' method.

3. (a) Explain the purpose of each of the following:

(i) telnet (5 marks)
(ii) ftp (5 marks)
(iii) DNS (5 marks)

(b) Describe the stages that an email passes through between being written by the originator to being read by the recipient. (10 marks)

Answer Pointers

(a) (i) Telnet is an Internet Application that permits users to login to a remote computer. It is also the name of the protocol for this purpose, e.g. telnet://remote.bcs.org.uk (5 marks)

(ii) FTP – file transfer protocol is a method of transferring files (often binary) over the Internet. It requires an FTP client which is often built into a web browser and an FTP server. (5 marks)

(iii) DNS – domain name server performs the resolution of a human friendly address such as www.bcs.org.uk into the corresponding IP address used to locate machines on the Internet. (5 marks)

(b) Composed in an email client
Sent to an email server
Routed over the internet to email server
Retrieved from the email server by the email client and read.

Better candidates may bring in details such as SMTP, POP3 and the division into packets. (10 marks)

Examiner's Guidance Notes
A surprising high number of candidates were unable to define telnet and few knew that it was a protocol. In part (b) some candidates wrongly focussed on the editing of the email, including detailed explanation of the commands within a typical mail client, but with little detail beyond the action of pressing send!

4. (a) Highlight the main differences between static and dynamic HTML. (10 marks)

(b) Briefly define each of the following terms and acronyms:
(i) Intranet and Extranet
(ii) HTTP and HTTPS
(iii) POP3 and IMAP
(iv) WAP and PPP
(8 marks)

(c) Define the term 'metadata' and describe some of the uses of the META element within the header section of an HTML document. (7 marks)

Answer Pointers
(a) The answer should be similar to:
Static web sites consist of HTML (hypertext markup language) pages that do not change unless the webmaster modifies the tags directly within the page. Static web sites are usually easier to develop but are very costly to maintain. They also often fall short on content because most of the information is not up- to-date and is usually presented is general in nature (because the pages are created for all users not for a specific user). The lack of content could eventually cause users to stop returning to the site on a regular basis.

Dynamic web sites consist of HTML pages that are created on the web server before they are sent to the user. Most dynamic web sites use a relational database management system (RDBMS) to create the dynamic content. Dynamic web sites are usually more expensive to develop but cheaper to maintain, often full of content and timely information. Also, dynamic web sites are usually more popular because the information displayed is regularly updated and can be customized specifically for users. The content may change according to the geographic location of the user, time of day etc. Technologies for producing it include cgi scripts, server side includes (ssi), javascript etc. When capitalized, Dynamic HTML refers to new HTML extensions that will enable a Web page to react to user input without sending requests to the Web

server. Microsoft and Netscape have submitted competing Dynamic HTML proposals to the Worldwide Web Consortium (W3C).

Sites can include a combination of static and dynamic content. Information that does not change often is best created statically whereas information that changes often should be created dynamically. A web site that contains both static and dynamic content is usually the most cost-effective option in the long run. (10 marks)

(b) Intranet and Extranet
Intranet – subset of the Internet restricted to a particular group of users often within a company
Extranet - refers to an intranet that is partially accessible to authorised outsiders.

HTTP and HTTPS
Hypertext Transport Protocol
Secure HTTP

POP3 and IMAP
Post Office Protocol Version 3
Internet Message Access Protocol / Internet Mail Access Protocol

WAP and PPP
Wireless Application Protocol (WAP)
Point-to-Point Protocol

(8 marks)

(c) The answer should be similar to:
Metadata is data about data on the Web, including but not limited to authorship, classification, endorsement, policy, distribution terms, IPR, and so on

HTML lets authors specify metadata (information about a document rather than document content in a variety of ways).

For example, to specify the author of a document, one may use the META element as follows: <META name="Author" content="Jonathan Wallace">The META element specifies a property (here "Author") and assigns a value to it (here "Jonathan Wallace"). The meaning of a property and the set of legal values for that property should be defined in a reference lexicon called a profile. For example, a profile designed to help search engines index documents might define properties such as "author", "copyright", "keywords", etc.

The META element can also be used, for example, to cause the page to reload itself. The following sample META declaration:

<META http-equiv="Expires" content="Fri, 8 Nov 2002 14:25:27 GMT">

will result in the HTTP header:

Expires: Fri, 8 Nov 2002 14:25:27 GMT

This can be used by caches to determine when to fetch a fresh copy of the associated document. (7 marks)

Examiners' Guidance Notes
This question was generally answered reasonably well. Many candidates were able to score particularly well in part (b) of the question.

In part (a) whilst the best candidates were able to correctly differentiate between static and dynamic html and the benefits of dynamic html in particular, there were a number of candidates who were evidently confused as to the differences between static and dynamic html and to the benefits of dynamic over static html.

In part (b) it was necessary not only just to state, for example, PPP means 'Point-To-Point Protocol' but also that this is the protocol used to connect one computer to another and is typically used for dial-up connections to the Internet. Candidates who did not supply the clarification of the functionality did not gain all the available marks.

In part (c) again whilst the best candidates were able to define 'metadata' and give exemplars of its use in an HTML document, there were a surprising number of candidates who had no concept of what metadata was and the functionality it can provide within an Internet site.

5. (a) Define and differentiate between bitmap and vector graphics.
(6 marks)

(b) Briefly outline the need for image compression and the difference between lossy and lossless image compression.
(6 marks)

(c) There is a range of formats to deliver text, graphics, sound, animation and video on the Internet. What are the issues that need to be addressed when multimedia content is delivered on the Internet? Which formats are you most likely to use for such delivery? Justify your choices.
(13 marks)

Answer Pointers
(a) The answer should be similar to:
Computers display graphics in either vector or bitmap format. Understanding the difference between the two formats can help you work more efficiently with them.

Vector graphics
Vector graphics describe images using lines and curves, called vectors, which also include colour and position properties. For example, the image of a leaf is described by points through which lines pass, creating the shape of the leaf's outline. The colour of the leaf is determined by the colour of the outline and the area enclosed by the outline.

When you edit a vector graphic, you modify the properties of the lines and curves that describe its shape. You can move, resize, reshape, and change the colour of a vector graphic without changing the quality of its appearance. Vector graphics are resolution-independent, meaning they can be displayed on output devices of varying resolutions without losing any quality.
Bitmap graphics
Bitmap graphics describe images using coloured dots, called pixels, arranged within a grid. For example, the image of a leaf is described by the specific

location and colour value of each pixel in the grid, creating an image much in the same manner as a mosaic.

When you edit a bitmap graphic, you modify pixels, rather than lines and curves. Bitmap graphics are resolution-dependent because the data describing the image is fixed to a grid of a particular size. Editing a bitmap graphic can change the quality of its appearance. In particular, resizing a bitmap graphic can make the edges of the image ragged as pixels are redistributed within the grid. Displaying a bitmap graphic on an output device that has a lower-resolution than the image itself also degrades the quality of its appearance.

(6 marks)

(b) The answer should be similar to:
An image, 1024 pixel x 1024 pixel x 24 bit, without compression, would require 3 MB of storage and 7 minutes for transmission, utilizing a 64 Kbit/s, ISDN line. If the image can be compressed at a 10:1 compression ratio, the storage requirement is reduced to 300 KB and the transmission time drops to under 6 seconds.

In a distributed environment such as the Internet, large image files remain a major bottleneck within systems. Compression is an important component of the solutions available for creating file sizes of manageable and transmittable dimensions.

Platform portability and performance are important in the selection of the compression/decompression technique to be employed. Compression solutions today are more portable due to the change from proprietary high-end solutions to accepted and implemented international standards. JPEG has become an industry standard technique for the compression of continuous tone images.

Two categories of data compression algorithm can be distinguished:

Lossy techniques apply some filter function to the image which reduces the quantity of data, but cannot reproduce the original image. Lossy techniques cause image quality degradation in each compression/decompression step. Careful consideration of the human visual perception ensures that the degradation is often unrecognisable, though this depends on the selected compression ratio. In general, lossy techniques provide far greater compression ratios than lossless techniques.

Lossless coding guaranties that the decompressed image is absolutely identical to the image before compression. This is an important requirement for some application domains, e.g. medical imaging, where not only high quality is in demand, but unaltered archiving is a legal requirement. Lossless techniques can also be used for the compression of other data types where loss of information is not acceptable, e.g. text documents and executable programs.

(6 marks)

(c) This question is fairly open. A wide range of formats could be mentioned. A likely breakdown of marks would be:

Issues such as file size, download times and browser support

(5 marks)

Formats: a selection from GIF, JPEG, FLASH / SHOCKWAVE, WAV, MIDI, MOV, PDF etc. (4 marks)

Justifications might include:
Compact file size commensurate with quality of the artefact and reasonable download time
Browser support (4 marks)
(Total Marks: 13)

Examiner's Guidance Notes
Whilst most candidates answered parts (b) and (c) of the question reasonably consistently, the answers supplied for part (a) were very varied. There were a number of candidates who were not able to demonstrate an understanding of the fundamental differences between bitmap (raster) and vector graphics and the pros and cons of the two graphic formats.

In part (b) there were a few candidates who actually got the difference between lossy and lossless compression the wrong way around.

In part (c) whilst the majority of candidates were able to give a reasonable explanation as to issues of delivering multimedia content over the Internet and provide examples of differing formats available for delivery, the justification of the use of particular formats was uniformly weak.

6. With the proliferation of access to the Internet, Intellectual Property Rights (IPR) and their protection is becoming more and more of an important issue.

Intellectual Property Law encompasses copyright, trademarks and patents.

(a) The owner of copyright for a work has exclusive rights to do certain restricted acts in relation to the work. List the restricted acts. (5 marks)

(b) List and explain the main requirements for a work to acquire copyright. (8 marks)

(c) It is a fairly simple matter to breach a copyright. International law distinguishes two forms of breach - Primary & Secondary – outline what constitutes a primary and secondary breach and give an example of each. (6 marks)

(d) Briefly outline the main differences between copyright and patent. (6 marks)

Answer Pointers
(a) Copyright – restricted acts
- They can copy the work in whole
- They can issue copies of the work to the public
- They can perform, show or play the work in public
- They can broadcast the work or include it in a cable programme
- They can make an adaptation of the work (1 mark each, max 5 marks)

(b) Copyright requirements

- Originality – product of authors efforts, not copied
- Tangibility – protects expression of idea, not the idea itself
- Qualification – reference to author/country where first published
- Ownership – protects author (for 70 years after death)

(2 mark each, max 8 marks)

(c) Copyright Breach

A *primary breach* is where someone deliberately breaks the terms of the licence under which they obtained the work, or uses the work without the permission or licence of the work's owner. This therefore includes:

- *Copying of the work - the owner of the work has exclusive rights to copying and any copying outside of that permitted by them is a breach of copyright,*
- *Making adaptations - this is where a person takes the work and makes modifications to it for their own purposes,*
- *The issuing of copies to the public - this includes lending, rental, leasing, etc., and importing works from elsewhere in the world for sale in the UK (the so called grey market); the latter is very complex - controls and exemptions vary depending on the class of work involved.*

A secondary breach is where someone infringes the rights of the works owner, following a primary breach by another person. This means:

- *Dealing in infringing copies - this is when a person knowingly distributes copies of the work which are in breach of copyright,*
- *Providing articles for the making of copies of the work - this does not means that a person provides a device or tool to circumvent the proprietary copy protection features of a particular work (this applies especially to copy protected or encrypted software),*
- *Related to the above, the circumvention of copy protection - which essentially means the creation of tools to circumvent the copy protection measures used to protect a work,*
- *Facilitating infringement by transmission - which means the transmission through any form of telecommunication of a copyright work without the permission of the work's owner; transmission of material across the Internet is a good example of this.*

(2 marks each for correct definition and one for an example of each type of breach, max 6 marks)

(d) Copyright v Patent

- Copyright is more general - applies to any original recorded work
- Copyright is more restricted - does not protect ideas/inventions but way they are expressed
- Patent prevents others from exploiting same idea - even if result of independent thought/activity

(2 marks each, max 6 marks)

Examiner's Guidance Notes

This question was the most poorly answered of all questions attempted. Whilst the majority of candidates were able to answer part (a) reasonably well, only a few

candidates were able to answer parts (b), (c) and (d) adequately. Whilst most were able to define a primary breach of copyright and provide an example, most were confused as to what constituted a secondary breach. Similarly few were able to distinguish between copyright and patent and explain the requirements for work to acquire copyright.