

**THE BCS PROFESSIONAL EXAMINATIONS**  
**Diploma**

**April 2006**

**EXAMINERS' REPORT**

**The Internet & World Wide Web**

**General Comments**

This paper required the candidate to attempt four questions from a choice of six. Some candidates answered more than 4 questions (but only received credit for their best four answers). The quality of answers ranged from incoherent to very good. Poor exam technique remains a problem. Too many candidates did not read the questions carefully enough and thus produced answers that did not address the points the examiners were expecting. Other problems included illegible handwriting and a failure to communicate in a clear and concise manner.

**Question 1**

1. You are to consider yourself as acting as a consultant to two companies seeking your advice on Web development. The only difference between the companies is the stage they are at in terms of Web presence.

The first company 'Beginners World' has no Web presence and is seeking your advice on how to start to have a presence on the Web. The second company 'Advanced World' has had a Web presence for 3 years and is starting to rely on Web customers to extend their market share across the world.

- a) Describe what advice you would give to each company with regard to investment in their Web presence. **(15 marks)**
- b) For each of the companies, outline the website design approaches that would make each site as usable and maintainable as possible. **(10 marks)**

**Examiner's Comments**

Two-thirds of candidates answered this question. Very few candidates listed any risks as part of their advice that would be associated with a greater web presence for either company. There was little discussion on the staff investments for each company or to give a suitably detailed plan for the approach to implement a new/improved presence. Many candidates discussed the inclusion of audio and video streaming as an essential improvement for the Advanced World company.

**Answer Pointers**

- (a) 'Beginners World'

Keep it simple – just static HTML.

Initially used to give information on the company and might invite feedback from potential customers.

Hosted by ISP with possible inclusion of catalogues/brochures – text and images only.

Designed and developed by external staff – web designer.

'Advanced World'

Depending on the initial 3 year uptake the company may be at a stage where it should consider hosting approaches and possibility of hiring their own designers and developers. Taking orders online and allowing payment over the Web – (ecommerce).

Answer should clearly differentiate between the risks for the two companies. It should outline the fact that skills and a lot of support are needed from outside the company for 'Beginners World'. Should not rely on Web presence generating revenue for the short term.

There should be a greater financial investment by 'Advanced World' in the areas of staff, equipment and hosting.

(b) Design issues

	'Beginners World'	'Advanced World'
Visual	Simple clear small set of pages with links between for key areas	Possible inclusion of tables and or frames
Navigation of content	Simple and clear	Breadcrumbs to show depth of links Menus Site Map Search options
Interactivity	Little interaction – perhaps email feedback	Forms for collection of customer data
Software to develop	NotePad, Word, FrontPage	Eg. Dreamweaver
Process to maintain system	Mostly static material and therefore periodic change	Dynamic and up to date requiring audit control of information.

**Question 2**

2. a) Explain the security risks that a home user faces when moving from a dial up to ADSL broadband Internet connection. Include in your answer suitable measures that can be taken to address these risks. **(10 marks)**
- b) What are the additional risks presented by wireless home networks and how can these be addressed? **(5 marks)**
- c) List the typical factors that affect the performance of an ADSL broadband Internet connection. **(5 marks)**
- d) Many users assume that they are anonymous when using the Internet. How valid is this assumption? **(5 marks)**

**Examiner's Comments**

Two thirds of candidates attempted this question. Many wrote about computer security risks in general and did not focus on the added risks brought by broadband nor the reasons for them. This was carried forward into their answer to part (b) where many candidates missed the point that this was about the *additional* risks. Some candidates misinterpreted security to mean safety and one proposed the use of a fire extinguisher! Few candidates answered part (c) well.

**Answer Pointers**

(a) A broadband connection is always on and often has a fixed IP address. Coupled with greater speed and bandwidth, this makes it an easier target than transient dialup connections.

Forms of attack may include:

- running malicious code such as viruses, Trojans, worms
- Spy ware giving access to sensitive or confidential information such as credit card details or tracking browsing habits
- Using it as a staging post to attack other computers on the Internet.

Methods include:

- Firewalls implemented in software or hardware to control access to the services offered on the machines behind the firewall.
- Encryption of sensitive information
- Use of secure protocols such as https and ssl.
- Closing down non-essential ports and services on computers
- Ensuring that the latest versions of software are used which contain the essential security patches
- Employing up to date virus scanning software
- Employing spyware removal tools

(b) Additional risks include:

- Unauthorised use of the connection for possibly illegal uses
- Interception of information

May be addressed by:

- Changing the default passwords and SSID
- Not broadcasting the SSID
- Restricting access to trusted MAC addresses
- Encryption of traffic using WEP or WPA

(c) Factors include:

- Distance from the exchange
- Age and condition of the wiring
- Contention ratio
- Designated speed of connection eg. 512K , 1M 2M
- Network congestion

(d) Assumption is invalid because:

- ISP logs use
- Web servers maintain logs
- Spyware tracks usage

### Question 3

3. a) i) Describe the octet format of the Internet Protocol (IP) addresses. **(4 marks)**
- ii) Explain the use of class divisions for a two-level hierarchy. **(3 marks)**
- iii) What is the benefit of using a three-level hierarchy? **(4 marks)**
- iv) Derive the number of networks and hosts that each of the classes can support. **(6 marks)**  
*[You may leave your answer as a power of 2.]*
- b) What are the advantages and disadvantages of using fixed and dynamic IP addressing? **(8 marks)**

### Examiner's Comments

Approximately half the candidates attempted this question. Most candidates could explain the format of the IP address, but many missed the simple network and host categorisation required for the two-level hierarchy. Few candidates discussed the use of submasks for the three-level hierarchy. The calculation of the number of networks and hosts for each Class was often presented in the reverse order for Class A and C and there were only a few candidates that discussed the overhead for the determination of the Class structure in use.

## Answer Pointers

(a)

(i) IP assigns a unique 32 bit Internet address value.

Dotted address

10001001 . 00000100 . 00100010 . 00100001

137.8.34.33

(ii) Basic two-level hierarchy

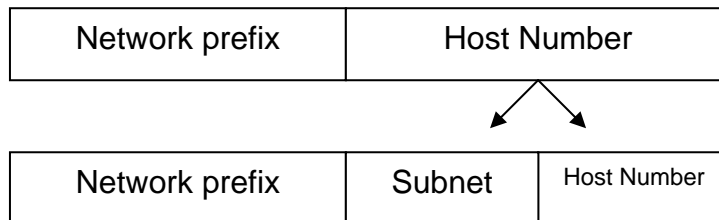
The first part of an IP address identifies the **network** and the second part identifies the particular **host**.

Not very efficient as the allocations are fixed and therefore the 'Net' has become poorly segmented.

(iii) Subnetting allows a three-level hierarchy.

Advantage of subnetting is to divide the standard host number field into two parts: the subnet number and the host number on that subnet.

Two-level and Three-level hierarchy



Subnetting is not visible outside of the organization's private network and therefore allows the network administrator to control the routing internally.

(iv)

IP address space was divided into three address classes - Class A, B and C.

In each case there is an overhead of bits required to determine the Class structure used.

Class A uses an 8 bit prefix and 24 bit host number

126 networks  $2^7 - 16,777,214$  224 hosts per network

Class B uses a 16 bit prefix and 16 bit host number

16,384 networks  $2^{14} - 65,536$   $2^{16}$  hosts per network

Class C uses a 24 bit prefix and 8 bit host number

2,097,152 networks  $2^{21} - 254$   $2^8$  hosts per network

(b)

Fixed – each machine has a permanent IP address (e.g. servers).

Dynamic – each machine is allocated an address from a pool when they connect (e.g. dialup accounts)

At least 3 advantages and disadvantages expected that cover:

Fixed	Dynamic
Used for server Configuration issues Possible conflict if reused Wasted if machine is offline	Use of DHCP server and what happens if it is offline and therefore more equipment required Allows easier allocation

#### Question 4

4. a) Explain the role and architecture of the Domain Name System (DNS) in the operation of the Internet. **(7 marks)**
- b) List FIVE typical reasons why users experience DNS errors. **(5 marks)**
- c) Building on, but not repeating your answer to (a), explain how the HTTP protocol facilitates the stages between a user requesting and receiving a web page. **(8 marks)**
- d) What are the main differences between HTTP and HTTPS? **(5 marks)**

#### Examiner's Comments

This question was attempted by nearly all candidates. Many displayed a worryingly vague understanding of how the DNS works and frequently confused DNS server with web server in their answer to part (b). Few students were able to demonstrate a detailed understanding of http and responses to part (d) were frequently limited to it being a secure version of http.

#### Answer Pointers

- a) DNS is domain name system. 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. It is organised in a hierarchical structure. Each ISP/company will maintain its own local name server. As well as maintaining details of the local network it will also cache recent requests. If it doesn't have the information required, then it will contact the root domain server. This will tell it which primary name server and secondary name server have the information about the requested URL.
- b)
- the URL does not exist
  - the URL has been mistyped
  - the local DNS is down
  - the request times out
  - network problems
- c)
- The user types the URL into the browser
  - The browser uses the DNS to identify the host web server
  - The browser uses HTTP to transmit the following request to the server: "GET /request-URI 4.HTTP/version", where version tells the server which HTTP version is used.
  - When the server receives the HTTP request it locates the appropriate document and returns it. However, an HTTP response is required to have a particular form. It must look like this:  
HTTP/[VER] [CODE] [TEXT]  
Field1: Value1 Field2: Value2

...Document content here...

The first line shows the HTTP version used, followed by a three-digit number (the HTTP status code) and a reason phrase meant for humans. Usually the code is 200 (which basically means that all is well) and the phrase "OK". The first line is followed by some lines called the header, which contains information about the document. The header ends with a blank line, followed by the document content.

- d) A secure means of transferring data using the HTTP protocol. Typically HTTP data is sent over TCP/IP port 80, but HTTPS data is sent over port 443 using secure socket layer or transport layer security. This standard was developed by Netscape for secure transactions, and uses 40-bit encryption ("weak" encryption) or 128-bit ("strong" encryption). If you are at a secure site, you will notice that there is a closed lock icon on the bottom area of your Navigator or IE browser. The HTTPS standard supports certificates. A webserver operator must get a digital certificate from a third-party certificate provider that ensures that the webserver in question is valid. This certificate gets installed on the webserver, and verifies for a period of a year that that server is a proper secure server. (Source: [www.tech-encyclopedia.com](http://www.tech-encyclopedia.com)).

### Question 5

5. a) What do the acronyms POP3, IMAP and SMTP stand for? **(6 marks)**
- b) With reference to the acronyms in a), describe the stages between the creation of an email by the sender to it being read by the receiver. **(10 marks)**
- c) From a user perspective, compare and contrast IMAP and POP3. **(5 marks)**
- d) Explain the principal features of webmail systems such as 'Hotmail'. **(4 marks)**

### Examiner's Comments

This was one of the most popular questions and it also had the highest pass rate.

Part (a) was well answered. Some candidates struggled to provide a detailed answer to part (b), omitted to explain the roles of the MUA/MTA/client-server architecture and were vague about the protocols involved. Part (c) was well done. In part (d) many candidates focussed on the cosmetic features of webmail and did not discuss the key technical differences. A significant number of candidates wrongly asserted that IMAP was involved in the reading of webmail. This may come from a misinterpretation of it being seen as an online protocol.

### Answer Pointers

- a) Post Office Protocol 3, Internet Mail Access Protocol, Simple Mail Transfer Protocol
- b) These protocols define the way that email is handled on the Internet:
- POP3 is the protocol that allows email retrieval and deletion/undelete.
  - IMAP is another protocol that handles email retrieval, but with increased manipulation capability.
  - SMTP is used for transportation of email from one host to another.
- Stages are:
- User creates an email using an email client (Mail User Agent - MUA) such as Microsoft Outlook, Eudora etc.
  - Mail program initiates an SMTP conversation with the outgoing mail server (Mail Transfer Agent -MTA) and transfers the email to it.

- c. The mail server examines the destination domain and opens up an SMTP conversation with the mail host of that domain, and transfers the mail to it.
- d. The mail host may then transfer the mail to the recipient's mail server within the domain
- e. The recipient uses a mail program (Mail Delivery Agent- MDA) such as Microsoft Outlook to retrieve the email from the server using POP3 or IMAP.

c)

POP3	IMAP
Allows access to inboxes but no other folders	Allows access to multiple mailboxes , folders and public folders
Retrieves mail from server, stores it locally and removes from server	Keeps mail on the mail server therefore providing centralised storage
Simple retrieval only.	More sophisticated retrieval and search functions
Easy for the ISP to manage	More complex

- d) Webmail is a way to read and send email messages using a web browser. Webmail does not require the use of any email client software. Webmail uses a web browser, web server, and mail server instead of an email client program to read and send messages. Webmail is a web application that uses a web server for both the user interface and to communicate with a mail server for reading and sending messages. This means that it uses the HTTP protocol rather than POP3/IMAP. SMTP is still used for the transportation of email from the web server to other email hosts.

Benefits include:

1. access to mail from anywhere on the internet without any custom software, settings, or system configuration. This makes it ideal for checking messages while travelling, or otherwise away from a primary computer.
2. keeps all messages on the mail server so they are always available, even after they have been read. No more need to archive messages, or synchronize mail folders between machines.
3. does not require messages to be downloaded until read, which is useful for checking the headers of large attachments without waiting for the attachments to download.

### Question 6

6. a) i) Differentiate between bitmap and vector graphics. **(6 marks)**
- ii) Select TWO still and TWO motion file formats used on the Web and identify their attributes in relation to bitmap and vector formats. **(8 marks)**
- b) i) Describe the trade-off between compression and quality for images. **(4 marks)**
- ii) If you have a 56Kbps modem, calculate how long will it take to download an uncompressed 10 second video clip, under optimal conditions, if the video is 15 frames per second (fps) and resolution of 160 x 120 pixels in 256 colours? [*Candidates must show their working.*] **(4 marks)**
- iii) Explain why you are unlikely to achieve this performance in practice. **(3 marks)**

### Examiner's Comments

One third of candidates attempted this question. Most did not state the obvious fact that the pixels of a raster were on a regular grid, but on the whole candidates could differentiate between vector and raster graphics. There was considerable confusion of the formats that supported bitmapped and vector graphics for the web and there was limited detail given on both still and motion formats. Candidates, in the main, were able to discuss the trade-offs of quality and compression and recognised that smaller files usually resulted in poorer quality images. Only a small number of

candidates calculated the approximate time required to download the video clip and even less could give the appropriate reasons why the full 56Kb bandwidth was normally reduced.

**Answer Pointers**

(a) (i) Raster also known as bitmap of points set on a regular grid representing the colour at every point. Typical arrangement for monitor display, but suffers from resizing as interpolation is used. Vector uses shapes of lines and curves that can be rescaled.

ii)

	Still	Motion
Vector	SVG / Encapsulated PostScript (EPS) / WMF / CGM	Flash (SWF) / Shockwave
Raster	JPEG / PNG / Gif	Motion JPEG / FLC is an Autodesk Flick movie and is a raw, uncompressed series of frames / MPEG to a degree as it allows for the use of references to other frames

(b) (i) Essentially the trade-off in increasing compression is that there are more of the bits that form the image or video removed and as a result a poorer reproduction is formed.

(ii) 160 x 120 per image = 19200 by 1 byte  
 10 x 19200 for 10 seconds = 192000 bytes  
 15 x 190000 frames = 2880000 bytes  
 2880000 times 8 bits = 23040000  
 23040000 / 56000 bits per second = 411 seconds (approx.)

(iii) 56K modems can only operate at 56K under ideal conditions: the telephone system will have a degree of noise and this is likely to reduce the data transfer speed. Switches and particularly long connection lines will also affect the transfer speed. The data packets downloaded include 'hand-shaking' so some of the data transfer per second is not the file content.