THE BCS PROFESSIONAL EXAMINATIONS
Diploma

April 2007

EXAMINERS' REPORT

Principles on Internet Technologies

QUESTION ONE

(a) i) Define the term "web search engine". **(2marks)**

ii) Explain how a web search engine resolves a query. **(3 marks)**

iii) Highlight THREE challenges faced by web search engines. **(3 marks)**

(b) The WWW is used for a diverse range of purposes. Identify FIVE distinct categories of website (in terms of intended purpose) and, for each category, identify an appropriate real-life example. **(5 marks)**

(c) Explain the terms weblog (often known as blog) and wiki, highlighting their common features and their differences. **(6 marks)**

(d) What is the role of an RSS feed on a webpage? **(6 marks)**

The definition for part (a) i) was typically only half described in required detail. The process for resolving a web query was poorly understood and the challenges were also poorly described. The range of purposes for the Web were well answered, but in some cases examples were not included. Blogs were quite well understood and could be differentiated from wikis. RSS feeds were also well understood.

Answer Pointers

(a)

i) A web search engine is a document retrieval system designed to help find information stored on the World Wide Web. The search engine allows one to ask for content meeting specific criteria (typically those containing a given word or phrase) and retrieves a list of items that match those criteria. (Adapted from Wikipedia)

ii)

- Web pages are retrieved by a Web crawler, an automated Web browser which follows every link it sees.
- The page contents are analysed
- This data is stored in an index database for use in later queries.
- When a user makes a query, the engine looks up the index and provides a listing of best-matching web pages according to selected criteria

iii)

- The Web is growing much faster than any present-technology search engine can possibly index
- Many web pages are updated frequently, which forces the search engine to revisit them periodically.
- Dynamically generated sites may be slow or difficult to index
- Some search-engines do not rank results by relevance, but by the amount of money the matching websites pay.
- tricks are used by many web sites to manipulate a search-engine to display them in the higher results for numerous keywords

(b) Types of website include:

- Educational
- Governmental
- Support (Help, drivers etc)
- Commercial
- Entertainment
- Community/Informational

(c) A weblog, which is usually shortened to blog, is a type of website where entries are made (such as in a journal or diary), displayed in a reverse chronological order. Blogs often offer commentary or news on a particular subject, such as food, politics, or local news; some function as more personal online diaries. (Wikipedia)

A wiki is a type of website that allows users to easily add, remove, or otherwise edit and change most available content, sometimes without the need for registration. This ease of interaction and operation makes a wiki an effective tool for collaborative writing. (Wikipedia)

Common features:

- They are web sites
- Usually open to anyone
- Allow comments

Differences:

- Authorship – Wiki – collaborative, blog – personal
- Purpose – Wiki – to develop a document, blog – to provide a commentary

(d) RSS is a format for facilitating the sharing of content on the web. The acronym RSS can variously stand for 'Rich Site Summary', 'RDF Site Summary' or 'Really Simple Syndication'. The format is based on XML and is frequently associated with the syndication of newsfeeds.

QUESTION 2

(a) Expand each of the following and define their meaning:
i) TCP/IP
ii) FTP
iii) HTTP
iv) IMAP
v) HTML **(10 marks)**

(b) The current Internet Protocol allows for approximately 4,000 million unique addresses – which is quickly becoming exhausted.

Define what is meant by IPv6 and NAT (sometimes known as IP masquerading). How can these help in solving the address shortage? **(5 marks)**

(c) Explain the role and architecture of the Domain Name Service (DNS) in the operation of the Internet. **(5 marks)**

(d) Building on, but not repeating your answer to (c), explain how the HTTP protocol facilitates the stages between a user requesting and receiving a web page.**(5 marks)**

Part a) was generally well done. Many candidates erroneously indicated that IMAP was used in webmail. By definition, webmail uses http. Few candidates demonstrated a good understanding of how IPv6 and NAT could help in addressing the address shortage. The operation of DNS was poorly understood and many candidates were unable to give any depth in their answer to part d)

Answer Pointers

(a)
i) Transmission Control Protocol / Internet Protocol – A set of two communications protocols which offer reliable delivery (c.f. UDP/IP) across diverse networks. IP defines the underlying network layer, whilst TCP is the transport layer, providing the reliable delivery over IP.

ii) File Transfer Protocol – A protocol used for efficient transfer of files across the Internet using the client-server model

iii) Hypertext Transfer Protocol – A protocol used for the transfer of web files across the Internet using the client-server model..

iv) Internet Mail Access Protocol – A mail protocol used in the final delivery of mail that interfaces with mail stored on a server, rather than fetching and storing mail on the local host machine.

v) Hypertext Markup Language – A markup language used to create web pages.

(b)
• IPv4 worked on 32-bit addressing. IPv6 (Internet Protocol version 6) uses 128-bit addresses, allowing for 3.4 x 1038 addresses. This is in the order of 1029 times greater than IPv4.

• NAT (Network address translation) allows private networks to share a limited number of external IP addresses. Traffic inside the network uses internal IP addresses (in the ranges 10.x.x.x, or 192.168.x.x) which do not have to be unique across the entire Internet, only on the local network. Traffic heading outside of the network has its IP address rewritten to one of the external IP addresses.

(c) 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 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.

(d)
1. The user types the URL into the browser.
2. The browser users the DNS to identify the host web server.
3. The browser uses HTTP to transmit the following request to the server: "GET /request-URI HTTP/version", where version tells the server which HTTP version is used.
4. 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.

QUESTION THREE

(a) Draw what the browser window will display:

i) initially on loading **(4 marks)**

ii) when the first main option is chosen **(3 marks)**

iii) when the second main option is chosen along with the second sub- option **(3 marks)**

(b) When is it appropriate to use client-side scripting or to use server-side scripting? Illustrate your answer with suitable examples. [Do NOT write any code.] **(10 marks)**

(c) Describe the issues associated with browser compatibility for client-side scripting languages. **(5 marks)**

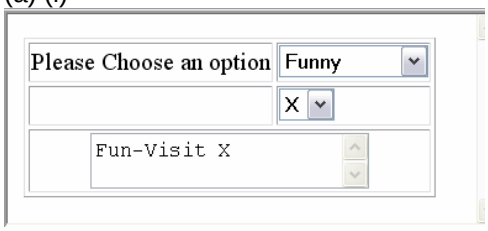
```
1 :<html>
2 :  <head>
3 :    <title>Viewing Options</title>
4 :    <script LANGUAGE="JavaScript">
5 :    <!--
6 :    function JumpPointer(){
7 :      var selection =
          document.f1.Sites.options[document.f1.Sites.selectedIndex].text;
8 :      document.f1.url.length = null;
9 :      if ( selection.match(/Educational/) ) {
10:        document.f1.url.options[0] = new Option('A', 'Visit A');
11:        document.f1.url.options[1] = new Option('B', 'Visit B');
12:      } else {
13:        document.f1.url.options[0] = new Option('X', 'Visit X');
14:        document.f1.url.options[1] = new Option('Y', 'Visit Y');
15:      }
16:      followup();
17:    }
18:    function followup(){
19:      document.f1.result.value = null;
20:      document.f1.result.value =
          document.f1.Sites.options[document.f1.Sites.selectedIndex].value + "-"
          + document.f1.url.options[document.f1.url.selectedIndex].value;
21:    }
22:    //-->
23:    </script>
24:  </head>
25:  <body onLoad="javascript:JumpPointer();">
26:    <form name="f1">
27:      <table border="1">
28:        <tr>
29:          <td>Please Choose an option</td>
30:          <td><select name="Sites" onChange="javascript:JumpPointer();">
31:          <option value="Education">Educational</option>
32:          <option value="Fun" selected>Funny</option>
33:          </select></td>
34:        </tr>
35:        <tr>
36:          <td> </td>
37:          <td><select name="url" onChange=" javascript:followup();">
38:          </select></td>
39:        </tr>
40:        <tr>
41:          <td colspan="2" align="center">
42:          <textarea name="result" rows="2" cols="20"
43:          readonly></textarea></td>
44:        </tr>
45:      </table>
46:    </form>
47:  </body>
48:</html>
```

(a) i) Many candidates used radio buttons instead of the list boxes required. Few presented the HTML table with column span across the two columns correctly. (a) ii) The detail of the creation of an option with the correct use of parameters was poorly represented by candidates. (b) Few discussed the dynamic changes that could be made to the client web pages by using Javascript and manipulating the Document Object Model. Most candidates knew that client scripts were readable and were mostly used to verify Web form information. Fewer candidates discussed the potential time saved by not having to send information to the

server that could be checked on the client browser. All knew of the need to use the server side to protect passwords when validating user credentials. (c) Most recognised that a browser needed to have the capability of interpreting Javascript, but few mentioned the issue of the feature being disabled by the user within their browser. Few discussed the interaction with the DOM and no one discussed the issues of supporting the debugging process. This was not a popular question with candidates.

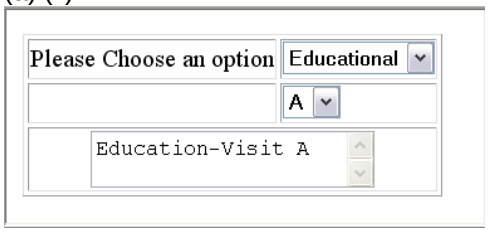
Answer Pointers

(a) (i)



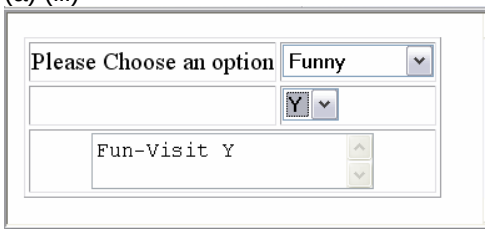
2 Marks for creating the table correctly and 2 marks for the correct content.

(a) (ii)



2 marks for the correct content for sub-option and 1 mark for text area content.

(a) (iii)



2 marks for the correct content for sub-option and 1 mark for text area content.

(b) Both offer the ability to dynamically change the web pages depending on the users' choices. They can be combined together to include the best of both features.

On client-side – Javascript offers embedding code that is visible to user in source and can manipulate the DOM objects. It can be used to verify data before the synchronous transmission to the server. This can save time in communication to the server and return to client.
On server-side – Likes of PHP used to communicate web pages that are typically driven by a database. Often used to verify session / cookie and passwords for security.

(c) Needs browser to have JavaScript functionality
Needs to be turned on
May deal with interaction with DOM in different ways
Debugging is difficult and poorly supported

QUESTION 4

(a) Define and distinguish between the terms intranet, Internet and extranet. **(5 marks)**

(b) Highlight advantages and disadvantages of extranets for a company. **(5 marks)**

(c) Describe the principle features of a portal, with reference to an example. **(5 marks)**

(d) What is the role of the W3C? **(5 marks)**

(e) Define the term website accessibility and give THREE examples of methods to improve access. **(5 marks)**

Part a) was generally well done although some candidates referred to networks without stressing that they should be using internet protocols. Answers to part b) were not specific enough and many could equally apply to intranets and the Internet. Portals were poorly understood and many candidates gave examples which were not portals. The basic role of the W3C was understood but few candidates were able to broaden their answer. Many candidates confused accessibility with usability.

Answer Pointers

(a) Intranet - An intranet is a private computer network that uses Internet protocols, network connectivity, and possibly the public telecommunication system to securely share part of an organization's information or operations with its employees.
Internet - The Internet is the worldwide, publicly accessible network of interconnected computer networks that transmit data by packet switching using the standard Internet Protocol (IP).
Extranet - An extranet is a private network that uses Internet protocols, network connectivity, and possibly the public telecommunication system to securely share part of an organization's information or operations with suppliers, vendors, partners, customers or other businesses. An extranet can be viewed as part of a company's Intranet that is extended to users outside the company (e.g. normally over the Internet). (Adapted from Wikipedia)

(b) Advantages:
- o can improve organisation productivity by automating processes that were previously done manually (eg: reordering of inventory from suppliers).
- o can also reduce the margin of error of these processes.
- o allow organization or project information to be viewed at times convenient for business partners, customers, employees, suppliers and other stake-holders
- o Information on an extranet can be updated, edited and changed instantly. All authorised users therefore have immediate access to the most up-to-date information.
- o can improve relationships with key customers, providing them with accurate and updated information.

Disadvantages:
- o can be expensive to implement and maintain within an organisation (eg: hardware, software, employee training costs) - if hosted internally instead of via an ASP.
- o Security can be a big concern when dealing with valuable information. System access needs to be carefully controlled to avoid sensitive information falling into the wrong hands.
- o can reduce personal contact) with customers and business partners. This can lead to a lack of connections made between people and a company, which hurts the business when it comes to loyalty of its business partners and customers.

(c) A web portal is a site on the World Wide Web that typically provides personalised capabilities to its visitors, providing a pathway to other content. It is designed to use distributed applications, different numbers and types of middleware and hardware to provide services from a number of different sources. Business portals are designed to share collaboration in workplaces. Content will increasingly work on multiple platforms such as personal computers, personal digital assistants (PDAs), and cell phones.

(d) The World Wide Web Consortium (W3C) is an international consortium where member organizations, a full-time staff and the public work together to develop standards for the World Wide Web. W3C's stated mission is "To lead the World Wide Web to its full potential by developing protocols and guidelines that ensure long-term growth for the Web."[1] W3C also engages in education and outreach, develops software, and serves as an open forum for discussion about the Web.

(e) Web accessibility is the practice of making Web pages accessible to people using a wide range of user agent software and devices, not just standard Web browsers. This is especially important for people with disabilities such as visual impairment.
Examples include:

- good design
- speech or voice browsers to read textual content aloud
- Speech recognition software, which can be useful for those who have difficulty using a mouse or a keyboard.
- Screen magnification software, which enlarges what is displayed on the computer monitor, making it easier to read for vision-impaired users.
- Keyboard overlays, which can make typing easier and more accurate for those who have motor control difficulties.

QUESTION 5

(a) Briefly explain the purpose of each of the following:
SMTP Server
Proxy Server
POP3 Server
DNS Server
DHCP Server

(10 marks)

(b) Explain the technical differences between webmail and conventional email systems. **(5 marks)**

(c) Give an example of one current method of receiving email in a mobile environment and evaluate the advantages and disadvantages of your selected method. **(5 marks)**

(d) “Video telephony is the killer application for 3G”. Discuss the validity of this statement. **(5 marks)**

Many candidates ignored the word “server” in part a) and focussed on the protocol. Similarly in part b) many candidates ignored the word “technical” and focussed on cosmetic differences. Part c) was generally well done although some candidates provided rather generic advantages and disadvantages. The term “killer application” was frequently misunderstood and one candidate described the dangers of radiation!

Answer Pointers

(a) A SMTP server on the Internet is used for the transfer of email using the Simple Mail Transfer Protocol. It takes connections from email clients and transfers messages to other SMTP servers.
A proxy server sits between client Web browsers and a Web server to filter and cache Web content and improve network performance. The primary purpose is the security function to inspect incoming and outgoing traffic and determining what should be denied transmission, reception or access.
A POP3 server on the Internet is used in the last stage of email delivery. It accepts connections from email clients and handles the delivery of email using the Post Office Protocol Version 3.
A DNS server provides the address resolution function of the domain name system.
A DHCP server manages the allocation of dynamic IP addresses on internal networks. It provides each network client with an IP address, subnet mask, default gateway, an IP address for a WINS server and an IP address for a DNS server.

(b) 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.

(c) Methods could include:
- Wireless hotspots
- Mobile phones
- Satellite technology

(d) Japan is currently the country with the highest uptake of 3G. Their experience has been that video telephony is not the killer application. Music downloads appear to be more important and this experience is being repeated in other countries.

QUESTION SIX

(a) Outline THREE distinct methods by which a home user can connect their PC to the Internet. **(5 marks)**

(b) List FOUR factors that a user should consider when choosing a method of connecting their PC to the Internet. **(6 marks)**

(c) Evaluate EACH of the methods identified in part (a) against EACH of the factors identified in part (b). Present your answer as a table, e.g.

	Factor One	**Factor Two**	**Factor Three**	**Factor Four**
Method One				
Method Two				
Method Three				

(14 marks)

Many candidates discussed leased lines and ISDN for part (a). Few mentioned wireless in detail – WiFi. When comparisons were made the relative speeds should have been stated.

The factors of speed and bandwidth were often stated as two completely separate factors, but they should have been related together.

Answer Pointers

(a) Broadband
- Wired
- Wireless through a router

Dial-up

(b)

	Performance	Reliability	Downtime	Security issues
Broadband - Wired	High capacity – 100Mbit Ethernet to router and then limited by line speed from 512Kbit upwards	too many people looking to sign-up to the service (high uptake) - too many users on at once and server can not cope with demand (loading)	Always connected	Normal username and password issues
Broadband – Wireless	High capacity – 54Mbit Ethernet to router and then limited by line speed from 512Kbit upwards Requires a router with WiFi capabilities			WPA or other encryption to enhance security to stop others using your router and bandwidth
Dial-up	Limited to 56kbit	Not supported as well and not intended for any upgrade to service	Required to connect each time	Normal username and password issues

General points between each:

Comparison of performance in Kilobytes / Megabytes versus cost to
- Install Equipment – modem type
- Telephone line support – distance for exchange / quality of cabling
- Ongoing monthly cost

Reliability - is the bandwidth that is quoted in the signup agreement achievable
- too many people looking to sign-up to the service (high uptake)
- too many users on at once and server can not cope with demand (loading)
- is the provider reputable and offers helpful service for problems

Downtime to be minimised