

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

April 2011

EXAMINERS' REPORT

Principles of Internet Technologies

General Comments

Students are stronger on textbook material than on practical application; where practical understanding was evident it tended to be stronger on core, older, technologies, than on more recent practices. Even textbook style answers tended to be quite high level compared to previous years. A worryingly high proportion of candidates demonstrated poor examination techniques including:

- Illegible handwriting
- Overlong answers in proportion to the marks available
- Misreading of the question and hence providing irrelevant answers

Section A

- A1**
- | | | | |
|----|------|--|------------------|
| a) | i) | Explain the role of ADSL in broadband Internet access. | (5 marks) |
| | ii) | What is “the local loop”? | (2 marks) |
| | iii) | What is local loop unbundling? | (2 marks) |
| | iv) | Internet Service Providers often use the term “up to”, e.g. speeds of up to 8Mbps, when they advertise their services. What are the factors which make this necessary? | (6 marks) |
| b) | i) | Why is there a growing demand for high-speed Internet access through mobile devices such as smart phones? | (6 marks) |
| | ii) | Outline TWO technologies which allow such access. | (4 marks) |

Answer Pointers

- a) i) Asymmetric Digital Subscriber Line (ADSL) is a digital technology for providing broadband internet access over a normal copper telephone line. It is significantly faster than conventional dial-up connection. At the exchange end it uses a Digital Subscriber Line Access Multiplexer (DSLAM). A splitter separates the broadband traffic from telephone traffic and the line may be used for telephone calls simultaneously. Speed is determined by line length and there is a maximum limit beyond which the technology will not operate.

- ii) The local loop is a reference to the final connection to the customer, typically the copper telephone line between the exchange and the customer.
 - iii) Local loop unbundling is where multiple operators are allowed access to the local loop to provide their own services.
 - iv) The speed of ADSL is dependent on factors such as line length, attenuation, the quality of the line and the signal to noise ratio. These factors mean that customers will rarely get full speed access - which has forced the use of "up to" in their marketing.
- b) Reasons may include the increased availability and capability of smartphones as well as their use for remaining connected to email and social networking sites.
Potential technologies include:
- 1. The mobile phone network – outline will include the use of base stations, cells, and the various generations including WAP, EDGE, UMTS & HSPA+
 - 2. WiFi outline will include hotspots, hardware incwireless access points, infrastructure and range
 - 3. WiMax - coverage of similar issues to the above.

Examiners' Guidance Notes

This question was answered by approximately three quarters of candidates but only one in five candidates achieved a pass mark. The question was about ADSL technology but few candidates demonstrated an understanding of the technology behind ADSL. Many failed to explain that it operated on normal copper telephone cables and some suggested it used fibre optic lines. Few mentioned the termination of a DSLAM at the exchange.

Local loops and local loop unbundling were poorly understood. In part b), some candidates in correctly referred to satellite technology and many listed variants of mobile phone technologies as though they were independent methods.

- A2**
- a) For each of the following, state what the acronym stands for and give an example of its use:
 - i) HTTP
 - ii) SMTP
 - iii) POP3
 - iv) DHCP
 - i) NNTP
 - ii) FTP

(12 marks)
 - b) What is client-server architecture? Illustrate your answer by giving three different examples of its use on the Internet.

(5 marks)
 - c) The world is running out of IPV4 addresses.
 - i) Give two reasons for this.

(2 marks)
 - ii) State two potential solutions to this problem and explain how they resolve it.

(6 marks)

Answer Pointers

- a)
 - i) Hypertext transfer protocol - www protocol controls communication between web clients and servers
 - ii) Simple Mail Transfer Protocol for transferring email across the Internet
 - iii) Post Office Protocol V3 for retrieving email from an email server
 - iv) Dynamic Host Configuration Protocol for the dynamic allocation of IP addresses
 - v) Network news transfer protocol for the transfer of Usenet news messages
 - vi) File transfer protocol for the transfer of files
- b) Client/server architecture describes a type of relationship between two computers. One (the client) makes a service request of the other (the server). Examples include email exchange, web access and database access.
- c)
 - i) More devices are being networked, e.g. Blu ray players, media players, fridges etc. More people are using these devices.
 - ii) IPv6 (Internet Protocol version 6) uses 128-bit addresses, allowing for 3.4×10^{38} addresses. This is in the order of 10^{29} 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.

Examiners' Guidance Notes

This question was attempted by almost all candidates and the success rate was high. Part a) was generally well done although NNTP was frequently expanded incorrectly. The Internet is largely based on client server architecture yet some candidates chose to give examples which were bizarre, e.g. being served in a bank! Variants of part c) had been set previously and some candidates made errors in their reproduction of sample answers, e.g. writing 10^{29} as 1029.

- A3**
- a)
 - i) What is an open mail relay?
(2 marks)
 - ii) Explain why some will welcome this whilst others will frown upon it.
(4 marks)
 - b)
 - i) Explain the differences between dynamic and static ip addressing.
(2 marks)
 - ii) Explain the differences between dynamic and static routing.
(2 marks)
 - c)
 - i) Explain how a web search engine builds its database and resolves a query.
(4 marks)

- ii) Explain THREE problems faced by web search engines. **(3 marks)**
- iii) Explain why two different search engines may provide different results when provided with the same search term. **(3 marks)**
- d) Outline what the W3C means by web accessibility and explain why it is important. **(5 marks)**

Answer Pointers

- a)
 - i) An open mail relay is an smtp server which has been configured to allow anyone to send mail through it.
 - ii) Good: allows anyone to send mail; not tied to being on own network.
Bad: Allows spamming.
- b)
 - i) If a computer has a static address, it always has the same address and this facilitates the addressing of servers. Dynamic addresses are allocated from a pool when a computer connects by a DHCP server. This is more appropriate for transitory connections.
 - ii) In static routing, the routing table has specific paths to specific destinations which don't change according to network traffic. Dynamic routing allows packets to have multiple routes to a destination according to network conditions. The routing table is built dynamically by routing protocols which change according to network traffic and conditions.
- c)
 - i) 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.
 - ii) 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.
 - iii) Different search engines may have a different weighting for the relative importance of the elements of the search terms. The indexes depend on the way that the web crawlers have searched the web, which will obviously differ from site to site.
- d) Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web. Web accessibility also benefits others, including older people with changing abilities due to aging.

The Web is an increasingly important resource in many aspects of life: education, employment, government, commerce, health care, recreation, and more. It is essential that the Web be accessible in order to provide equal access and equal opportunity to people with disabilities. An accessible Web can also help people with disabilities more actively participate in society.

Examiners' Guidance Notes

This question was attempted by 95% of candidates but only 56% achieved a pass mark. Many students confused an open mail relay with a webmail service as they interpreted the word "open" as "free". In common with previous years, there was much misunderstanding about web search engines. Candidates frequently believed that the Web crawler searched the web in response to the user typing in a search term, which is clearly impossible. There was also vagueness about what was being indexed. The final part of the question was about Web accessibility but many candidates focussed on all they knew about W3C and did not answer the question.

Section B

- B4**
- a) Illustrate the architecture of a typical AJAX web application, showing the relationships between each of the elements in the system and how data is passed between them.
(11 marks)
 - b) Identify the Client-side scripting language used in AJAX web applications and briefly describe the role it serves.
(4 marks)
 - c) Identify a common Server-side scripting language used in AJAX web applications and briefly describe the role it serves.
(4 marks)
 - d) For each of the following, state what the term stands for and briefly explain its purpose:
 - i) Apache
 - ii) Web User Agent
 - iii) DOM**(6 marks)**

Answer Pointers

- a) A diagram that shows both the client-side and server-side of an AJAX web application and a clear divide between them. On the server-side it would show a web server, data source and scripting elements indicating the relationships between each and with elements on the client-side. On the Client-side the diagram would show the client-side elements and the relationships between each and with the server-side. JavaScript, XML and the asynchronous connection between client and server sides should be included.
- b) Identify JavaScript and briefly discuss its role in controlling client-side interactions and asynchronous communications with the server-side.

- c) A common example would be PHP along with a brief description highlighting its role in controlling interaction between server-side components and in conditioning results to be served to the client-side.
- d)
 - i) Apache, a web server, delivery of content from the server-side to the client-side.
 - ii) Web User Agent, commonly a web browser but can be screen readers etc. The common purpose is to manage, process and render client-side communications.
 - iii) DOM, Document Object Model, an interactive model of Objects defined in a web page.

Examiners' Guidance Notes

Very few students attempted this question. Of the students that attempted the question, most did not answer part a) and a good proportion of those who did mostly gave a text-based answer rather than a diagram, or some combination of the two. Most students were able to identify the scripting languages used in parts b) and c) but had more difficulty describing their roles. Whilst almost all students who attempted part d) could answer part iii, fewer could answer part i and most could not correctly answer part ii.

- B5**
- a) In relation to Internet security, briefly explain:
 - i) what is a Firewall;
 - ii) a strength of using a firewall; and
 - iii) a weakness of using a firewall?

(4 marks)
 - b) Identify four common Internet security risks and briefly explain the measures that can be taken to guard against each.

(12 marks)
 - c) In the context of web server configuration, briefly state
 - i) what is a .htaccess file; and
 - ii) three uses for a .htaccess file

(9 marks)

Answer Pointers

- a)
 - i) Firewall, a hardware or software system that controls network access, limiting it to authorised communications or devices.
 - ii) Highly configurable control over communications management. Can be implemented in hardware resulting in fast operation and providing added security. Simple to manage.
 - iii) Configurability can lead to poor configuration and result in reduced security, not impenetrable, can be difficult to configure for some advanced uses.
- b) For example: Phishing, Spam, Virus, Trojan, Packet sniffer, Root kit, along with an appropriate description of each and the measures that can be used to counter them

(e.g. anti-phishing software, good security awareness, spam filters, virus checkers, properly configured firewalls and web servers).

- c)
 - i) A web server configuration file that can be used to configure a web server in a decentralised manner, right down to the level of an individual directory.
 - ii) For example: authorisation, access, MIME type and custom error control.

Examiners' Guidance Notes

This question was attempted by most of the students. Students were generally able to describe a firewall at a high level but did not seem to have the same lower level appreciation than in past years. The strengths and weaknesses highlighted were quite superficial and tended to simply extend to the description of a firewall. In answering part b) students were usually able to identify an appropriate set of risks and to describe them in some detail. Many were able to offer solutions such as the use of software to protect against the risks but fewer offered preventative solutions centred around good practice and risk awareness. Only a small subset of the students who answered the question attempted part c). Of those who did, only a few answered part i correctly and fewer still part ii. This was surprising as it tests a very practical aspect of web server security.

- B6**
- a)
 - i) Briefly state what the term XMLHttpRequest stands for and explain how it is commonly used in web authoring.
(5 marks)
 - ii) Identify and briefly describe THREE of the request methods commonly supported by user agents that support the use of the XMLHttpRequest.
(9 marks)
 - b)
 - i) Using XML data modelling, model a movie's data source in XML.
 - Provide XML markup for the data source
 - Provide XML markup for three example movies
 - Model the movie title, lead actor and director for each film**(8 marks)**
 - ii) With reference to the XML example in c) i), what task would the following JavaScript statement perform?

`getElementsByTagName("director")[0].childNodes[0].nodeValue`
(3 marks)

Answer Pointers

- a)
 - i) XMLHttpRequest is an API available in client-side scripting languages, commonly JavaScript, that facilitates direct requests to the server-side and dynamic loading of any results returned. Used in web applications to update parts of the DOM and display without the need to refresh the full document.
 - ii) For example, GET, POST, PUT, DELETE, HEAD or OPTIONS, along with a brief description.

b) <?xml version="1.0" encoding="UTF-8" ?>
 <movies>
 <movie>
 <title></title>
 <actor></actor>
 <director></director>
 </movie>
 <movie>
 <title></title>
 <actor></actor>
 <director></director>
 </movie>
 <movie>
 <title></title>
 <actor></actor>
 <director></director>
 </movie>
 </movies>

Including appropriate example data in each data tag.

Examiners' Guidance Notes

Very few students attempted this question. Of the students who attempted the question, most were able to define XMLHttpRequest but almost none of them could identify the common request methods, which suggests a lack of practical application in this area. A number of the students who attempted the question could answer part b) i, although a few confused this with other file types and markup languages. Most who attempted the question were able to state what the JavaScript statement in b) ii would return.