BCS HIGHER EDUCATION QUALIFICATIONS
Level 5 Diploma in IT

March 2012

EXAMINERS' REPORT

Principles of Internet Technologies

General Comments
The range of candidates' responses remains wide with weaker scripts demonstrating very little technical understanding of fundamental aspects. Illegible writing compounded with fragmented English made it difficult to award marks to some candidates.

Section A

A1. a) Explain the role each of the following technologies plays in delivering a dynamic website:
    i)   HTML
    ii) CSS
    iii) JavaScript
    iv) DOM
    v)   PHP
    vi) XML

(12 marks)

    b) Using only a labelled diagram, illustrate the architecture of a typical dynamic client-server website, showing the relationships between each of the elements in the system and how data is passed between them.
(10 marks)

    c) How does an AJAX website differ from other types of dynamic websites?
(3 marks)

Answer Pointers
a) Typically 1 mark for expanding on each acronym and a further mark for correctly expanded and their role accurately defined.

b) A clear and understandable labelled diagram identifying elements including:
    -   client and server sides, 2 marks
    -   client application with rendered webpage and DOM, 2 marks
    -   Webserver, 2 marks
    -   Database, 2 marks
    -   Appropriate data flows, 2 marks

c) Clearly expressed understanding of the nature of the asynchronous nature of AJAX and the usual markup and scripting languages used, 3 marks

Examiners' Guidance Notes
This question was attempted by two-thirds of candidates with reasonable success. Candidates generally performed better on the earlier elements of part *a* which covered basic concepts than on aspects such as DOM and XML. This was echoed in the answer to part *c*. Diagrams provided for part *b* tended to be too simple, although a few were exemplary.

A2. a) In the context of Internet security and NAT:
    i) What does the term NAT stand for?
    ii) How might NAT help with Internet security?
    iii) How effective is NAT for Internet security?
    iv) What is network masquerading?
    v) What is Port Forwarding?

(10 marks)

b) Explain what is meant by:
    i) cryptosystem
    ii) public key cryptography
    iii) digital certificate
    iv) certificate authorities

(8 marks)

c) In the context of computer security:
    i) What is meant by the term *rootkit*?
    ii) How can the presence of a rootkit be detected?
    iii) What action should be taken on finding a rootkit installed?
    iv) How can the installation of a rootkit be prevented?
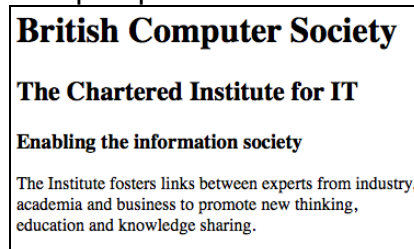
(7 marks)

Answer Pointers
a) i) Network Address Translation, 2 marks
    ii) By hiding the internal IP addresses of the nodes on a network and by restricting bi-directional communications from outside the network, 2 marks
    iii) Not particularly, they are not fundamentally intended for network security and are easily circumvented, 2 marks
    iv) A technique that hides a networks' address space behind a single IP address, 2 marks
    v) A techniques that allows external network traffic to pass through a specified port to reach a specific node on the hidden internal network's address space, 2 marks

b) i) General description of what a cryptosystem is and its use, 2 marks
    ii) Description of public key encryption including how the key is shared, 2 marks

iii) What a digital certificate is and its purpose in relation to the web,
2 marks

iv) Who certificate authorities are and their role, 2 marks

c) i) Definition of rootkit that shows good understanding, 1 mark

ii) Good understanding of practice and tools for detecting rootkit presence,
2 marks

iii) Clear understanding as to how to remove a rootkit including the tools to
use, 2 marks

iv) Good understanding of standard security measures for preventing
intrusions of this nature, 2 marks

Examiners' Guidance Notes
This question was attempted by half of candidates. Candidates largely had a good grasp of what NAT is but less so masquerading and port forwarding. General performance in relation to cryptography was possibly more balanced, whilst candidates' understanding of the challenge of dealing with rootkit-based security breaches was a little basic.

A3. a) Write HTML markup to produce the following output:

(5 marks)

b) i) What is the JavaScript language most commonly used for in web
development?

ii) Identify and correct FIVE errors in the JavaScript code below:

```
<script type="text/javascript">
    var start = "<p>";
    var end = "</p>";
    for i=1; i<=10; i++ {
        if (i%2) {
            document.write(start , i , end);
        }
</script>
```

iii) What is the function of the corrected code?

iv) Show the output from the corrected code.

(9 marks)

c) Provide example CSS rules to demonstrate how the following can be
achieved in CSS:

i) Group the HTML elements h1, h2 and h3 and assign them the
font style "strong".

ii)   Define a Class Selector to align text differently for two classes of paragraph.

iii)   Define an id Selector that aligns text to the centre.

(6 marks)

d)   Consider the following XML markup:

```
1       <?xml version="1.0" encoding="ISO-8859-1"?
2       <cricket ground history>
3            <stadium>
4                   <name>Eden Gardens</name>
6                   <matches>35</matches>
7            </stadium>
9                   <name>Feroz Shah Kotla</name>
11                  <matches>29</matches>
12           </stadium>
13      </cricket ground history>
```

i)   Identify THREE errors in the XML markup above.

ii)   Add a field to store the "city" in which each cricket ground is located.

(5 marks)

Answer Pointers

a)   e.g.   `<html>`

```
        <body>
            <h1>British Computer Society</h1>
            <h2>The Chartered Institute for IT</h2>
            <h3>Enabling the information society</h3>
            <p>The Institute fosters links between experts
            from industry, academia and business to
            promote new thinking, education and knowledge
            sharing.</p>
        </body>
</html>
```

General structure 1 mark and 1 mark for each of the content tags, total 5 marks.

b)   i)   e.g. client-side scripting, form validation, 2 marks

        ii)
```
<script type="text/javascript">
    var start = "<p>";
    var end = "</p>";
    for (i=1; i<=10; i++) {
        if (i%2) {
            document.write(start ; i ; end);
        }
    }
</script>
```
                1 mark for pair of missing brackets, 1 mark for pair of missing semicolons and 1 mark for missing brace, total 3 marks

        iii)   Output the odd numbers between 1 and 10 inclusive, each in a separate paragraph tag, 2 marks.

        iv)   1

3
                    5
                    7
                    9   2 marks

c)   Correctly formed CSS rules for each part, 2 marks each, total 6 marks.

d)   Consider the following XML markup:

        i)   1   `<?xml version="1.0" encoding="ISO-8859-1"?>`
                2   `<cricket ground history>` **SPACES in this tag and**
                                                  closing tag
                3   `<stadium>`
                4   `<name>Eden Gardens</name>`
                6   `<matches>35</matches>`
                7   `</stadium>`
                        `<stadium>`
                9   `<name>Feroz Shah Kotla</name>`
                11   `<matches>29</matches>`
                12   `</stadium>`
                13   `</cricket ground history>`
                1 mark for each error, total 3 marks

        ii)   Correctly formatted tag inserted into each stadium node, 2 marks.

Examiners' Guidance Notes
This question was attempted by only a third of candidates with the vast majority of them obtaining a pass mark on the question. This was the least popular question on the paper but the one where students performed best. Part *a* did not challenge most candidates, although many over complicated the solution and showed signs of slightly out-dated approaches to HTML mark-up. There was a wide range of correct and incorrect suggestions to possible errors in the JavaScript in part *b*. Writing CSS rules in part *c* did not challenge most candidates. Likewise, most candidates appeared to be very comfortable with XML mark-up.

Section B

B4. a) i) Briefly outline the role of a proxy server.

(2 marks)

ii) State THREE distinct uses of a proxy server.

(3 marks)

b) i) Briefly outline the role of a DNS server.

(2 marks)

ii) Give THREE distinct reasons for DNS error messages.

(3 marks)

c) i) Briefly outline the role of a DHCP server.

(2 marks)

ii) Are DHCP servers an essential part of the Internet? Justify your answer.

(3 marks)

d) i) What is client-server architecture?

(2 marks)

ii) What is peer-peer architecture?

(2 marks)

iii) What are the advantages and disadvantages of each?

(4 marks)

iv) Which of these architectures is most usually found on the Internet? Justify your answer.

(2 marks)

Answer Pointers

a) i) A proxy server is an intermediary server for requests from clients seeking other services.

ii) Answers may include:
Speeding up access to resources by caching
Providing anonymity to hosts e.g. TOR/IP2
To filter or block access to services/sites
To avoid the filtering/blocking of access to services/sites
To audit usage e.g. within a company (big brother)

b) i) A dns server provides the mapping between ip addresses and domain names

ii) Answers may include:
Dns server is unavailable/down
Requested domain does not exist
Request has timed out

c) i) A DHCP server provides the dynamic allocation of ip addresses (and other information) on a network.

ii) Without DHCP servers, ip addresses and associated information would need to be configured manually. Given the enormous number of devices connected to the Internet, this would be quite unmanageable. So, in theory they are not essential but in practical terms they are.

d)   i)   Client/server architecture describes the relationship between two computer programs in which one program, the client, makes a service request from another program, the server, which fulfils the request.

ii)   Peer-peer architecture describes the relationship between equally privileged peers which are both suppliers and consumers of resources.

iii)   P – P more robust than C-S as no single point of failure. C-S higher initial setup cost but more scalable and easier to administer. P- P typically less secure but easier to set up.

iv)   C-S more prevalent e.g. www, email, ftp etc.

Examiners' Guidance Notes
This question was attempted by four-fifths of candidates. Many confused the role of a proxy server (as an intermediary) with the applications that it could be used for. The question did not specify web proxies but most responses were limited to these. Given the fundamental nature of DNS, it remains a source of mystery and misconception to many candidates. DHCP servers were better understood, although many candidates thought them essential. Some justified their answers by discussing the shortage of IPV4 addresses but ignored IPV6.

B5.   a)   What do the following terms stand for and what is the purpose of each?
       i)   ftp
       ii)   http
       iii)   https
       iv)   smtp
       v)   ntp
       vi)   LDAP

(12 marks)

b)   Define and briefly explain the role of:
       i)   W3C
       ii)   IETF
       iii)   RFC
       iv)   IAB

(8 marks)

c)   Define the term *website accessibility* and give THREE examples of methods to improve access.

(5 marks)

Answer Pointers
a)   i)   File transfer protocol – file transfer over TCP based networks including the Internet

ii)   Hypertext transfer protocol – communication protocol for WWW

iii)   Hypertext transfer protocol Secure – combination of HTTP with SSL/TLS to provide encrypted communication

iv)   Simple mail transfer protocol – sending and transfer of email

v)   Network time protocol – used for the synchronisation of computer clocks across networks

      vi)   Lightweight Directory Access Protocol - accessing and maintaining distributed directory information services over an Internet Protocol (IP) network

b)   i)   World Wide Web Consortium develops standards for the WWW
      ii)   Internet Engineering Task Force is responsible for overseeing how the Internet's TCP/IP protocols evolve
      iii)   Request for Comments – used by IETF publish and seek feedback on new concepts which may go on to become Internet standards.
      iv)   Internet Activities/Architecture Board is responsible for the Internet Design architecture and management.

c)   Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web. This is important for equal opportunities as more of the everyday functions of life require the Web. Web accessibility also benefits others, including older people with changing abilities due to aging.
Answers may include:
1.   Images & animations: Use the alt attribute to describe the function of each visual.
2.   Image maps. Use the client-side map and text for hotspots.
3.   Multimedia. Provide captioning and transcripts of audio, and descriptions of video.
4.   Hypertext links. Use text that makes sense when read out of context. For example, avoid "click here."
5.   Page organization. Use headings, lists, and consistent structure. Use CSS for layout and style where possible.
6.   Graphs & charts. Summarize or use the longdesc attribute.
7.   Scripts, applets, & plug-ins. Provide alternative content in case active features are inaccessible or unsupported.
8.   Frames. Use the noframes element and meaningful titles.
9.   Tables. Make line-by-line reading sensible. Summarize.
10.   Check your work. Validate. Use tools, checklist, and guidelines at http://www.w3.org/TR/WCAG

Examiners' Guidance Notes
Most candidates attempted this question. Part *a* was straightforward yet some candidates were unable to define basic terms such as https, ntp and LDAP. Website accessibility is clearly defined by W3C but some candidates confuse this with Internet access methods.

B6.   a)   Explain what is meant by:
      i)   A *packet switched network*; and
      ii)   A *circuit switched network.*

      Which of these applies to the Internet?

(5 marks)

b)   i)   Explain the role of a router in the management of Internet traffic.

(5 marks)

      ii)   Explain the differences between dynamic and static routing.

(5 marks)

    c)   What are the main technical characteristics of broadband Internet access using ADSL?

(10 marks)

Answer Pointers

a)   i)   A packet switched network is one where there is no single unbroken connection between sender and receiver. Information is broken into packets which are sent over various routes and reassembled at the destination. (2 marks)

      ii)   A circuit switched network is one where once the connection is made, that part of the network is dedicated to the single connection. (2 marks)

The Internet is packet switched. (1 mark).

b)   i)   The role of a router is to ensure that packets arrive at the correct destination. The router examines the header of incoming packets and checks the destination against a routing table before forwarding them to their destination. (5 marks)

      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. (5 marks)

c)   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. (10 marks)

Examiners' Guidance Notes

This question was attempted by most candidates, yet the pass rate was relatively low at 55%. The understanding of packet switching and circuit switching was patchy. Some candidates suggested that the Internet was a mixture of the two. Many did not realise that the main application of circuit switching is the telephone network and some suggested that packets were circuit switched. Dynamic and static routing are totally separate concepts to the dynamic and static allocation of IP addresses. A worrying number of candidates wrote about dynamic routing requiring dynamic IP addressing as they confused these concepts. Part *c* was carefully worded to emphasise the technical characteristics of ADSL but some candidates strayed into other aspects such as pricing and marketing. A few confused it with fibre and wireless technologies.