

BCS THE CHARTERED INSTITUTE FOR IT
BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

PRINCIPLES OF INTERNET TECHNOLOGIES

Wednesday 30th March 2016 - Morning
Answer **any** FOUR questions out of SIX. All questions carry equal marks.
Time: TWO hours.

Answer any Section A questions you attempt in Answer Book A
Answer any Section B questions you attempt in Answer Book B

The marks given in brackets are **indicative** of the weight given to each part of the question.

Calculators are NOT allowed in this examination.

Section A
Answer Section A questions in Answer Book A

General Comments

Candidates, again, chose to answer more questions from Section B than Section A. Some, candidates produced weak answers for a Section B question rather than attempt a Section A question. This suggests more practice and revision is required for the programming elements of Internet Technologies.

Fundamentals of computer networks, such as the TCP/IP model and how common protocols map to this model require more understanding. Mobile/cell technology related questions were also weakly answered; and as we move further into the “Internet of Things” this technology will become more prevalent.

Technical language is required to gain full marks, and whilst partial credit was given for metaphorical answers, for full marks, the candidate needs to demonstrate the vocabulary and knowledge of a professional within the field.

It appears that candidates heeded the previous warnings of illegible handwriting, as this was much improved.

Section A

Answer Section A questions in Answer Book A

A1. a) In relation to JavaScript, briefly state what each of the following terms refer to:

- i) Array
- ii) Boolean
- iii) Event
- iv) Keyword
- v) Script

(5 marks)

b) Consider the following JavaScript code and identify 5 errors:

```
<script type = "text/javascript"
  var firstName = John;
  var lastName = "Smith"
  var fullName = firstName + " "lastName;
  document.write("My name is "+fullname);
</script>
```

(5 marks)

c) In relation to JavaScript:

i) Write code for a JavaScript function that:

- reads in two numbers from an HTML form
- determines which number is the largest
- outputs to screen which number is the largest (in the format *44 is larger than 22*)

(10 marks)

ii) Write an appropriate HTML form which will call this function.

(5 marks)

Answer pointers (A1)

a) A brief statement correctly defining each term.

**1 mark each
Total 5 marks**

b)

```
<script type = "text/javascript">
  var firstName = "John";
  var lastName = "Smith";
  var fullName = firstName + " "+lastName;
  document.write("My name is "+fullName);
</script>
```

**1 mark per error
5 in total**

C)(i)

```
function largest(){ //2 marks
var numA = parseInt(document.myForm.numA.value); //1 mark
var numB = parseInt(document.myForm.numB.value); //1 mark
if (numA > numB){ //1 mark
    document.write(numA + " is larger than "+numB); //1 mark
}
else if (numA < numB){ //1 mark
    document.write(numB + " is larger than "+numA); //1 mark
}
else{ //1 mark
document.write("Both numbers are equal"); //1 mark
}
}
```

C)(ii)

```
<form name="myForm" action=""> //1 mark
```

```
Enter first number <input type="text" name="numA"><br> //1 mark
Enter second number <input type="text" name="numB"><br> //1 mark
<input type="button" value="click" onclick=largest();> //2 marks
```

```
</form>
```

Examiners' Guidance Notes (A1)

Candidates answered part (a) well and generally had a good understanding of the concepts involved. Some candidates incorrectly called JavaScript "Java". There needs to be a greater awareness of the differences between the two languages. Candidates produced some strong answers in identifying the errors in part (b). Part (c) produced some mixed responses. Many candidates did not demonstrate an awareness of how to give variables values, and how to call a function within an HTML form.

- A2. a)** What are the three types of CSS? **(6 marks)**
- b)** What type of CSS is recommended when designing websites? Justify your choice. **(4 marks)**
- c)** Write a CSS rule that would change the font in all paragraph elements to Arial and the colour of the font to red. **(6 marks)**
- d)**
- i)** Write a CSS rule for an ID selector that would define the font to be italic and position the text to the right. **(6 marks)**
 - ii)** Write a declaration for this rule to show how it can be applied to a particular header element. **(3 marks)**

Answer pointers (A2)

a) external, internal and inline //2 marks each, 6 in total

b) External - 2 marks, make one change, reflected everywhere - 2 marks

c)

```
p{ //2 marks
font-family:"Arial"; //2 marks
color: red; //2 marks
}
```

d)(i)

```
#Test //2 marks
{
    font-style: italic; //2 marks
    text-align: right; //2 marks
}
```

d)(ii)

```
<h1 id="Test">Lorem Ipsum</h1>
```

1 mark for the header tag, 1 mark for the correct use of ID, 1 mark for sample text - 3 marks in all

Examiners' Guidance Notes (A2)

This was the most popular question in Section A with candidates demonstrating that they knew CSS theory and could apply it to CSS rules and HTML. Part (a) was answered well and most candidates knew which type of CSS was appropriate for designing websites for part (b). For part (c), some candidates did not get the names of the properties right and this was reflected in part (d)(i) as well. Candidates also need be aware of the differences between an ID selector and a class selector in CSS. In part (d) most candidates answered this well but some got the HTML tag for the header wrong.

- A3. a)** In relation to XML data modelling:
- i) expand the acronym XML
 - ii) model a *university* data source: and
 - iii) model the *name*, *address*, and *course* for each *student* and
 - iv) provide XML mark-up for a student

(8 marks)

b) State what AJAX is. Provide two advantages of using AJAX on a web page. **(9 marks)**

c) Identify and briefly describe the two XMLHttpRequest methods that will relay a request to a server. **(8 marks)**

Answer pointers (A3)

a) i) EXtensible Markup Language

```
<?xml version="1.0" encoding="UTF-8"?>
<university>
  <student>
    <name>John Smith</name>
    <address>20 Main Street, Belfast</address>
    <course>Computing Science</course>
  </student>
</university>
```

b) asynchronous JavaScript and XML and definition(3 marks)
User doesn't have to refresh page, allows for greater personalisation (3 marks each)
9 in total

c) .open – specifies the request – 4 marks
.send – sends the request – 4 marks
8 in total

Examiners' Guidance Notes (A3)

This was the least popular question in Section A. Many candidates only attempted some of the parts. There was a good understanding of what an XML model was in part (a). Candidates gave informed answers for part (b). However part (c) was not answered well and answers tended to be generic rather than specific.

Section B

Answer Section B questions in Answer Book B

B4. a) Expand each of the following acronyms:

- i) TCP
- ii) UDP
- iii) HTTP
- iv) ICMP
- v) ARP
- vi) DNS

(6 marks)

- b)** Map the previous six protocols found in part a) to the TCP/IP model. **(6 marks)**
- c)** Comparing and contrasting their similarities and their differences, describe the main features of TCP and UDP. **(6 marks)**
- d)** HTTP is described as a stateless protocol. In this context, define what stateless means and provide THREE examples of how a web application maintains state given that HTTP is stateless. **(4 marks)**
- e)** Briefly explain the role of DNS and its supporting role in the operation of the Internet. **(3 marks)**

Answer pointers (B4)

- a)
- TCP - Transmission Control Protocol
 - UDP - User Datagram Protocol
 - HTTP - Hypertext Transfer Protocol
 - ICMP - Internet Control Message Protocol
 - ARP – Address Resolution Protocol
 - DNS - Domain Name System

(6 marks)

b)

Protocol	TCP/IP Layer
TCP	Transport Layer
UDP	Transport Layer
HTTP	Application Layer
ICMP	Internet layer
ARP	Link Layer
DNS	Application Layer

(6 marks)

c) TCP and UDP are both found in the transport layer of the TCP/IP model and both used in sending packets over the Internet. TCP is connection-oriented, meaning the communication path is established beforehand (3-way handshake). While UDP is connectionless, meaning no connection is established beforehand. For these reasons, UDP provides only best effort delivery, whereas TCP is designed to be reliable (unless connection is lost). TCP is also slower than UDP for this reason. TCP provides an ordered stream of data, whereas UDP does not.

(6 marks)

d) HTTP is stateless as the connection between the server and client is lost once the transaction finishes. State is maintained by, for example, using server side sessions, HTTP cookies, encodes URLs, databases and programming variables.

(4 marks)

e) Hierarchical (tree), worldwide-distributed structure. Address resolution, recursion and caching.(3 marks)

Examiners' Guidance Notes (B4)

This was the weakest answered question in Section B. Many candidates were unable to map the protocols found in part a) to the TCP/IP model; and those who did have an understanding of the TCP/IP model invariably mapped one or two protocols to the incorrect layer. Part b) was answered excellently by a small number of candidates, but many candidates did not know about TCP or UDP. Very few candidates understood the concept of statelessness in part d), but most who attempted this question confused "statelessness" for HTTPS, meaning most attempts at this answer failed to also provide three examples of maintaining state. Many candidates used the phonebook metaphor for DNS in part e), but for full marks it was expected that candidates would provide more technical language commensurate to this level.

- B5. a)** Expand each of the following acronyms and briefly explain their purpose:
- i) IP
 - ii) FTP
 - iii) SSH
 - iv) DHCP
 - v) NAT
- (10 marks)**
- b)** Write an example of an IPv4 address, then go on to describe how many distinct addresses there can be when using the IPv4 address space.
- (3 marks)**
- c)** Explain the importance of NAT in the context of IPv4 addressing
- (3 marks)**
- d)** Provide FOUR advantages of IPv6 over IPv4.
- (4 marks)**
- e)** Explain what is meant by:
- i. a packet switched network
 - ii. a circuit switched network
- Which of these applies to the Internet?
- (5 marks)**

Answer pointers (B5)

- a)
- IP – Internet Protocol – Main communications protocol. It delivers packets based on IP addresses.
- FTP – File Transfer Protocol – Used to transfer files from one host to another.
- SSH – Secure Shell – Allows remote login and access to network services securely where it would not normally be secure.

DHCP – Dynamic Host Configuration Protocol – Automatically provides a device with its IP address and other related configuration information.

NAT - Network Address Translation – Remaps one IP address space into another (10 marks)

b) Technically anything from 0.0.0.0 to 255.255.255.255. IPv4 using 32bit addressing (2^{32}), so 4,294,967,296 possible addresses (4.2 billion is an acceptable answer if the 2^{32} was also identified).

(3 marks)

c) With the expansion of the Internet, the IPv4 address space is becoming exhausted. NAT allows internal networks to share IP addresses.

(3 marks)

d)

Exhausted address space of IPv4 (increased to 128 bit addressing)

Quality of Service (QoS) built-in

Increased efficiency in routing (IPv6 routers no longer have to fragment packets)

Improved header structure (some fields removed from IPv6 header that were rarely used under IPv4).

Network layer security built in (IPsec). IPsec support is only optional under IPv4

(4 marks)

e)

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.

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

The Internet is packet switched.

(5 marks)

Examiners' Guidance Notes (B5)

This was the most popular question in Section B, and was answered well by a majority of the candidates. In part a) most candidates were able to expand and explain the acronyms, although few were able to provide a correct answer for SSH. Candidates were largely able to provide an example of an IPv4 address in part b), but not all knew how many distinct IPv4 addresses there are. Part c) was generally answered well, but more technical language was required to gain full marks. Part d) was the weakest part, with many candidates able to identify the address space increase in IPv6, but all other suggestions focussed on this address space increase, meaning no further credit could be awarded. Part e) produced some excellent answers with many candidates scoring high marks.

- B6. a)** Expand the following in the context of a mobile/cell phone operation:
- i) EDGE
 - ii) GSM
 - iii) HSPA
 - iv) 4G
 - v) WAP
- (5 marks)**
- b)** From a security perspective, why do network administrators prefer to use managed switches over hubs for their computer networks? In your answer, provide a brief explanation on how hubs and switches work.
- (4 marks)**
- c) i)** Identify THREE threats a company can face against their computer network from an external attacker.
- (3 marks)**
- ii)** How can a company protect themselves from the threats you identified in part c) i)?
- (3 marks)**
- d) i)** Explain the role of a web scraper.
- (1 mark)**
- ii)** Provide TWO examples where using a web scraper may be useful.
- (2 marks)**
- iii)** What issues, legal and ethical, may arise when using web scraping software?
- (3 marks)**
- e) i)** In computer networks, define what is meant by a 'proxy server'?
- (1 mark)**
- ii)** Provide THREE benefits of using a proxy server.
- (3 marks)**

Answer pointers (B6)

a)

EDGE - Enhanced Data rates for GSM Evolution

GSM - Global System for Mobile Communications (was originally 'Groupe Spécial Mobile')

HSPA - High Speed Packet Access

4G – Fourth generation

WAP - Wireless Application Protocol

(5 Marks)

b) Hubs are considered 'dumb' and transmit all data to all connected ports; a malicious user could intercept these transmissions even if they were not the intended recipient. This poses a security issue to users. Managed switches know which device is the recipient of the data, meaning only that device will receive it. Managed switches also provided facilities to provider better control over the LAN.

Marks)

c)

i) Some examples, although any reasonable answers were acceptable:

Malicious software (viruses/malware/Trojans/spyware/Rootkit etc)

Denial of Service (DoS)/Distributed Denial of Service (DDoS)

Physical attack on network.

Phishing attack

(3 Marks)

ii) Any reasonable solution/preventative measure acceptable.

(3 Marks)

d)

i) To extract data, e.g. such as files, from a specific website. (1 Mark)

ii)

Data mining (analysis/researching).

Evidence gathering (law enforcement).

Archiving.

Other reasonable answers acceptable.(2 Marks)

iii)

Breach copyright/intellectual property laws if you are not the content owner.

Break website's terms and conditions of use.

Deny website owner any potential advertising revenue, as a scraper bypasses the regular way a user would visit a website.

Scraping and storing data could breach data protection laws.

Usually ignores robot.txt, whereas a crawler would not. (3 Marks)

d)

i) A server that acts as an intermediary between clients and other servers.

(1 Mark)

ii)

Can improve performance (caching)

Anonymity & privacy

Bypass content restrictions

Implement content restrictions (3 Marks)

Examiners' Guidance Notes (B6)

Part a) was the weakest answered part, with no candidate able to correctly expand all the acronyms, although many were able to get "Fourth Generation". Part b) was answered to a good standard with many able to provide a sensible explanation of how hubs work; for full marks, a comparison was required between managed switches and hubs. Many candidates were able to get full marks in both part c)i and c)ii, but some candidates would identify consequences of threats, rather than actual threats in c)i. Part d) was answered incorrectly by all but a handful of candidates, mainly due to candidates confusing a web scraper with a web crawler. There is a distinct difference. Due to this incorrect answer in part d)i few candidates went on to score well in part d)ii and d)iii. Candidates largely had some understanding of a proxy server, but few could identify benefits.