About A Level

COMPUTER SCIENCE
Paper 1
2210

(TOPICAL)

About **Teacher's Comments**

When solving problems, we first analyse the questions and then gather relevant information until we are able to determine the answers. But for presentation reason, we need to rearrange and then present ONLY the required workings and solutions.

Teacher's Comments reveal the extra but relevant information which is not required as part of the solutions.

period	**2014 to 2024**	
contents	**June & November Exams, P1 Worked Solutions**	
form	**Topic By Topic**	
compiled for	**O Levels**	
special features	**Teacher's Comments**	

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Revised Syllabus

Revision: June / November **2024** Paper 1

TOPIC 1.1
Number Systems

Question 1

An encryption system gives each letter of the alphabet a value:

A = 1, B = 2, C = 3, ………… , Y = 25, Z = 26

Each letter is stored in a 12-bit binary register. The letter "**S**" (19th letter) is stored as:

2048	1024	512	256	128	64	32	16	8	4	2	1
0	0	0	0	0	0	0	**1**	**0**	**0**	**1**	**1**

A 4-bit register is used to store the encryption key. This register shows how many places the bits are shifted to the left in the 12-bit register when it is encrypted. So,

8	4	2	1
0	**1**	**0**	**1**

means each bit in the 12-bit register is shifted 5 places to the left and the register now becomes:

2048	1024	512	256	128	64	32	16	8	4	2	1
0	0	1	0	0	1	1	0	0	0	0	0

Therefore, the letter "**S**" would be transmitted with the 4-bit register and the 12-bit register as follows:

0	1	0	1	0	0	1	0	0	1	1	0	0	0	0	0

(a) "**W**" is the 23rd letter of the alphabet.

   (i) Show how this letter would be stored in the 12-bit register before encryption:

   (ii) The 4-bit register contains the following value:

8	4	2	1
0	**1**	**1**	**0**

   Show how the letter "**W**" is now stored in the 12-bit register in encrypted form:

[2]

(b) Find which letter of the alphabet has been encrypted here. (Show all your working.)

0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0

....

....

....

.... [2]

(c) **(i)** What is the largest encryption key that can be stored in the 4-bit register?

8	4	2	1
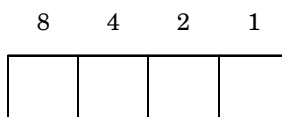
(ii) Convert this into denary (base 10).

....

(iii) If this encryption key were used, what problem would it cause?

....

.... [3]

[J14 / P1 / Q16]

Question 2

An advertising sign uses large LED characters controlled by a microprocessor.

Each letter is formed from a grid made up of eight rectangles numbered 1 to 8:

1	2	3	4
5	6	7	8

For example, the letter "Z" is formed as follows:

1	2		4
5		7	8

Each rectangle has six LEDs that can light up; these LEDs are labelled "a" to "f":
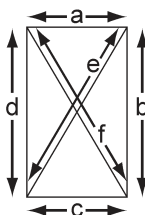
The LEDs in a rectangle can be represented in a 6-bit register. For example, rectangle 3 of the letter "Z":
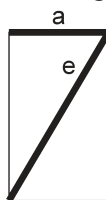
can be represented as:

f	e	d	c	b	a
0	1	0	0	0	1

Thus the letter "Z" can be represented by the 8 registers:

	f	e	d	c	b	a
1	0	0	0	0	0	0
2	0	0	0	0	0	1
3	0	1	0	0	0	1
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	1	0	1	0	0
7	0	0	0	1	0	0
8	0	0	0	0	0	0

(a) Show how the letter "E" can be represented by the eight 6-bit registers (four registers have been done for you).

f	e	d	c	b	a	
0	0	0	0	0	0	1
						2
						3
0	0	0	0	0	0	4
0	0	0	0	0	0	5
						6
						7
0	0	0	0	0	0	8

[4]

(b) State which letter of the alphabet is represented by the following eight 6-bit registers. [2]

f	e	d	c	b	a	
0	0	0	0	0	0	1
0	0	1	0	0	0	2
0	0	0	0	1	0	3
0	0	0	0	0	0	4
0	0	0	0	0	0	5
0	0	1	0	0	1	6
0	0	0	0	1	1	7
0	0	0	0	0	0	8

letter ....

[N14/P1/Q12]

Question 3

Draw a line to connect each question to the correct answer.

Question		**Answer**

| What is the denary (base 10) equivalent to the hexadecimal digit **E**? | | **8** |

| If 1 GB = 2^x then what is the value of X? | | **12** |

| How many bits are there in one byte? | | **14** |

| If the broadband data download rate is 40 megabits per second, how many seconds will it take to download a 60 MB file? | | **19** |

| What is the denary (base 10) value of the binary number 0 0 1 0 0 1 0 0 ? | | **30** |

| What hexadecimal value is obtained when the two hexadecimal digits **C** and **D** are added together? | | **36** |

[5]

Question 4

Letters from the alphabet are represented in a computer by the following denary (base 10) values:

$$A = 97$$
$$G = 103$$
$$I = 105$$
$$L = 108$$
$$N = 110$$

The word "**A L I G N**" is stored as: 97 108 105 103 110

(a) Convert each of the five values to binary. The first one has been done for you.

Letter	Denary value							
A (97):	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**1**
L (108):								
I (105):								
G (103):								
N (110):								

[2]

(b) An encryption system works by shifting the binary value for a letter one place to the left. "A" then becomes:

1	**1**	**0**	**0**	**0**	**0**	**1**	**0**

This binary value is then converted to hexadecimal; the hexadecimal value for "A" will be:

C 2

For the two letters "L" and "G", shift the binary values one place to the left and convert these values into hexadecimal:

hexadecimal

L:									....
G:									....

[4]

Question 5

Sensors and a microprocessor monitor a car exhaust for high temperature and high carbon monoxide (CO) levels.

The information from seven sensors is sent to an engine management system in the car. The status of each sensor is stored in an 8-bit register; a value of 1 indicates a fault condition:
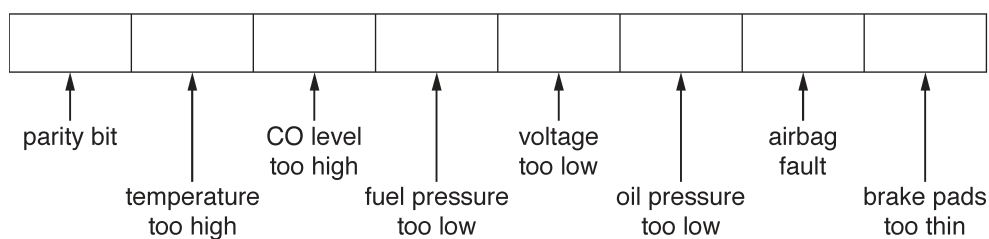
For example, a register showing **0 1 0 1 1 0 0 0** indicates:

- temperature too high
- fuel pressure too low
- voltage too low

(i) Identify the fault condition(s) that the following register indicates:

0	0	1	0	0	1	0	1

....

....

.... [2]

(ii) The system uses **odd** parity.

Write the correct parity bit in each register.

	1	1	1	0	0	1	0

	0	0	0	1	1	1	0

[2]

(iii) A car has a faulty airbag and the CO level is too high.

Write what should be contained in the 8-bit register.

[2]

(iv) Give the hexadecimal value of the binary number shown in **part (iii)**.

....

.... [1]

[N15 / P11 / Q2(b)]

Question 6

(a) (i) Convert the following **two** hexadecimal numbers into binary:

F A 7
D 3 E

F A 7

D 3 E

[4]

(ii) Now perform the AND (logic) operation on each corresponding pair of binary bits in the two numbers from **part (i)**.

[2]

(iii) Convert your answer in **part (ii)** into hexadecimal.

....

.... [2]

(b) **(i)** The following code shows HTML 'tag' pairs on either side of the text stating the colour that each creates.

```
<font color " # F F 0 0 0 0 " > RED </font>
<font color " # 0 0 F F 0 0 " > GREEN </font>
<font color " # 0 0 0 0 F F " > BLUE </font>

<font color " #      X      " > YELLOW </font>
<font color " #      Y      " > MAGENTA </font>
<font color " #      Z      " > CYAN </font>
```

Yellow is a combination of red and green, magenta a combination of red and blue and cyan a combination of green and blue.

State what 6-digit hexadecimal values should replace X, Y and Z in the above code.

X ....

Y ....

Z ....

[3]

(ii) Describe how other colours, such as a darker shade of blue, are created.

....

....

.... [2]

[N15/P12/Q4(a,b)]

Question 7

(a) Convert the following hexadecimal number into 12-bit binary:

<div align="center">

4 A F

</div>

[3]

Q1 - Solution

(a) **(i)**

0	0	0	0	0	0	0	1	0	1	1	1

(ii)

0	1	0	1	1	1	0	0	0	0	0	0

(b) The 4 bit encryption register has a value of 3. Therefore the unencrypted value of the alphabet would be the encrypted value in the 12 bit register, shifted 3 places to the right. Hence, the unencrypted binary value would be 0 0 0 0 0 0 0 1 1 0 0 1. This value, in decimal, is 25 which means that the letter Y was encrypted.

(c) **(i)**

8	4	2	1
1	1	1	1

(ii) The value in denary is 8 + 4 + 2 + 1 = 15.

(iii) A shift of 15 places to the left would cause the original letter to be lost, as the 12 bit register will now be completely filled with zeros.

Q2 - Solution

(a)

f	e	d	c	b	a	
0	0	0	0	0	0	1
0	0	1	0	0	1	2
0	0	0	0	0	1	3
0	0	0	0	0	0	4
0	0	0	0	0	0	5
0	0	1	1	0	1	6
0	0	0	1	0	1	7
0	0	0	0	0	0	8

1	2	3	4
5	6	7	8

(b) Letter formed is H.

Teacher's Comments:

No LED will light up in rectangle 1.
The Left most LED of rectangle 2 will light up.
The Right most LED of rectangle 3 will light up.
No LED will light up in rectangle 4.
No LED will light up in rectangle 5.
The Left most and Top most LED of rectangle 6 will light up.
The Right most and Top most LED of rectangle 7 will light up.
No LED will light up in rectangle 8.

Q3 - Solution

Question		**Answer**

What is the denary (base 10) equivalent to the hexadecimal digit **E**?

If 1 GB = 2^X then what is the value of X?

How many bits are there in one byte?

If the broadband data download rate is 40 megabits per second, how many seconds will it take to download a 60 MB file?

What is the denary (base 10) value of the binary number

0 0 1 0 0 1 0 0 ?

What hexadecimal value is obtained when the two hexadecimal digits **C** and **D** are added together?

8

12

14

19

30

36

Q4 - Solution

(a)

Letter	Denary value							
A (97):	0	1	1	0	0	0	0	1
L (108):	0	1	1	0	1	1	0	0
I (105):	0	1	1	0	1	0	0	1
G (103):	0	1	1	0	0	1	1	1
N (110):	0	1	1	0	1	1	1	0

(b)   **hexadecimal**

L:	1	1	0	1	1	0	0	0
G:	1	1	0	0	1	1	1	0

L: **D8**

G: .... **CE**

Q5 - Solution

(i) CO Level too high.
Oil Pressure too low.
Brake Pads too thin.

(ii)

1	1	1	1	0	0	1	0

0	0	0	0	1	1	1	0

(iii)

1	0	1	0	0	0	1	0

(iv) A 2

Q6 - Solution

(a) (i)   F A 7
D 3 E

F A 7	1	1	1	1	1	0	1	0	0	1	1	1

D 3 E	1	1	0	1	0	0	1	1	1	1	1	0

(ii)

1	1	0	1	0	0	1	0	0	1	1	0

(iii) D 2 6

(b) (i) X: FF FF 00
Y: FF 00 FF
Z: 00 FF FF

(ii) Different combinations in HEX codes, corresponding to different shades, can be created by combining values between 0 to F.

Q7 - Solution

(a)

0	1	0	0	1	0	1	0	1	1	1	1

(b) (i)

0	1	1	0	1	0	0	1

hours

0	0	0	1	1	1	1	1

minutes

0	0	1	1	0	0	1	0

seconds

(ii) 1F

Q8 - Solution

(a)   Denary Value $= 2^6 + 2^5 + 2^4$
$$= 64 + 32 + 16 = 112$$

(b)   Denary number $= 2^5 + 2^4 + 2^3$
$$= 32 + 16 + 8 = 56$$

(c)   Original denary number is divided by 2

(d) (i)

0	0	0	0	1	1	1	0

(ii) Equivalent Denary Number $= \left(\left(\left(\frac{112}{2} \right) \div 2 \right) \div 2 \right)$
$$= 14$$

(e)   The rightmost '1' in the original binary number would be lost. Therefore, instead of getting $112 / 2^5 = 3.5$, we would only get 3, thereby incurring a loss of precision.

Q9 - Solution

(a)   For 57, The highest 2^n number that goes into 57 is 32 (i.e. 2^5)
Remainder = 57 – 32 = 25. The highest 2^n number that goes into 25 is 16 (i.e. 2^4)
Remainder = 25 – 16 = 9. The highest 2^n number that goes into 9 is 8 (i.e. 2^3)
Remainder = 1. The highest 2^n number that goes into 1 is 1 (i.e. 2^0)

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	0	1	1	1	0	0	1

Therefore, 57 in Binary = 00111001

(b)

0	0	1	1	1	0	0	1

Register 1

0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1

Register 2

(c) Use 1: The binary number can be used to represent a number.

Use 2: The binary number can be used to represent an instruction.

Teacher's Comments:

> The value represented by the binary number can be used to represent other things such as data, characters, ASCII values, information from a part of an image, a small sound or a part of a sound track, etc.

(d) 0011 in Binary is 3 in Hexadecimal.

1010 in Binary is A in Hexadecimal.

Hence, the overall binary integer in Hexadecimal is 3A.

Q10 - Solution

9:    LEFT

1:    DOWN

C: OPEN

3:    CLOSE

F: UP

Teacher's Comments:

> $9 = 2^3 + 2^0$ in Decimal i.e. 1001 in Binary.
>
> $1 = 2^0$ in Decimal i.e. 0001 in Binary
>
> $C = 2^3 + 2^2$ in Decimal i.e. 1100 in Binary.
>
> $3 = 2^1 + 2^0$ in Decimal i.e. 0011 in Binary.
>
> $F = 2^3 + 2^2 + 2^1 + 2^0$ in Decimal i.e. 1111 in Binary.

Q11 - Solution

(a) A Binary number system is a Base-2 System which uses values between 0 and 1, whereas a Denary number system is a Base-10 System which uses values between 0 and 9. Units in the Binary number system increase by a power of 2, whereas units in the Denary Number system increase by a power of 10. Lastly, for the same value, the Binary number system uses more digits as compared to the Denary number system.

(b) Set up a table with headings of "Powers of 2" in each column, starting from 2^0 for the least significant bit. Write down the digits of the binary number below the correct "Power of 2" heading. An example for the binary number 1010 is shown below:

2^3	2^2	2^1	2^0
1	0	1	0

Multiply the value in each column with it's respective "Power of 2" heading and add them together to obtain the final value. As an example:

1010 in Binary = $(2^3 \times 1) + (2^2 \times 0) + (2^1 \times 1) + (2^0 \times 0)$ = 8 + 0 + 2 + 0 = 10.

Q12 - Solution

(a)

Hours	0	0	0	0	0	0	1	0

Minutes	0	0	0	1	1	1	1	1

Seconds	0	0	1	1	1	0	1	0

(b) 00000101 corresponds to $2^2 + 2^0$ = 4 + 1 = 5

00011010 corresponds to $2^4 + 2^3 + 2^1$ = 16 + 8 + 2 = 26

00110111 corresponds to $2^5 + 2^4 + 2^2 + 2^1 + 2^0$ = 32 + 16 + 4 + 2 + 1 = 55

Topic 5   The Internet and its Uses

TOPIC 5.1

The Internet and the World Wide Web

Question 1

A student used the Internet to help with his Chemistry project. He typed the following into a search engine:

transition + elements

(a)   The first two search results listed were:

Chemistry of the **transition elements**

The **elements** of **transition** during computer animation

Considering these two examples, describe **one** problem when using search engines.

....

....   [1]

(b)   This search gave the student over 480 000 results ("hits").

Many of these results were not relevant.

How could the student obtain more relevant results?

....

....   [1]

(c)   Other than security issues, describe **one** undesirable feature of using the Internet when looking for information.

....

....   [1]

(d)   Describe **one** benefit of using the Internet to find information.

....

....   [1]

[J14/P1/Q4]

Question 2

Choose **six** correct terms from the following list to complete the spaces in the paragraphs below:

- encryption
- file name
- firewall
- HTML tags/text
- IP address
- protocol
- proxy server
- SSL certificate
- web server name

A user enters a URL. The web browser breaks up the URL into **three** components:

1 ....

2 ....

3 ....

The web server returns the selected web page.

The web browser reads the .... from the selected page and shows the correctly formatted page on the user's screen.

A .... is used between the user's computer and the network to examine the data traffic to make sure it meets certain criteria.

To speed up the access to the web pages next time, a .... is used between the computer and web server; this device uses a cache to store the website home page after it has been accessed for the first time.

[6]

[J15 / P11 / Q4]

Question 3

(a) Explain what is meant by HTML.

....

....

....

....

....

.... [3]

(b) HTML uses both structure and presentation.

Describe what is meant by the two terms.

Structure ....

....

....

Presentation ....

....

....

[2]

(c) Explain the function of a web browser.

....

....

....

....

....

.... [3]

[N15 / P12 / Q6]

Question 4

Describe the use of structure and presentation in a HTML document.

....

....

....

....

....

....

....

.... [4]

[J16 / P1 / Q11]

Question 5

(a)   Describe what is meant by HTML.

....

....

....

....

....

.... [3]

(b)   The following URL is typed in:

http://www.cie.org.uk/ComputerSciencePapers

This URL is composed of three parts.

State the part of this URL that is the:

File name ....

Protocol ....

Web server name ....
                                                                                                                                                  [3]

[N16 / P1 / Q10]

Question 6

A company sells smartphones over the Internet.

Explain how the information stored on the company's website is requested by the customer, sent to the customer's computer and displayed on the screen.

....

....

....

....

....

....

....

....

ANSWERS

TOPIC - 5.1

Q1 - Solution

(a) The search engine can pick up unwanted and unrelated websites.

(b) The student could narrow down the search criteria by incorporating more relevant keywords in the search.

(c) Unwanted advertisements and pop-ups can show up.

(d) Information is easier and faster to find as compared to looking up information in books and articles.

Teacher's Comments:

> The internet also allows access to recent and up-to-date information. Moreover, information can be directly copied and pasted into documents from internet browsers.

Q2 - Solution

1. File name,

2. Protocol,

3. Web server name.

The web browser reads the ....**HTML tags/text**................... from the selected page and shows the correctly formatted page on the user's screen.

A ....**Firewall**........................... is used between the user's computer and the network to examine the data traffic to make sure it meets certain criteria.

To speed up the access to the web pages next time, a ....**Proxy server**........ is used between the computer and web server; this device uses a cache to store the website home page after it has been accessed for the first time.

Q3 - Solution

(a) HTML stands for Hypertext Markup Language and is used to create webpages. It is translated by a browser to display webpages to the user.

(b) Structure refers to layout of the content being displayed.

Presentation refers to the formatting of the content such as content color/style.

(c) A web browser is used to display webpages by interpreting and translating a HTML document. It also provides functions such as bookmarking webpages and saving webpage URL's in its History.

Teacher's Comments:

> A web browser is also capable of interpreting embedded scripting such as JavaScript, and is also able to identify protocols such as Secure Socket Layer (SSL) or https.

Q4 - Solution

Within an HTML document, presentation is used to format the colors and styles used within the HTML document, whereas the structure is used to create the layout. The Presentation is often stored in a file called a Cascading Style Sheet (CSS), which is linked to the HTML document to implement the presentation requirements. On the other hand, the structure of the HTML document is defined by Mark-up tags.

Q5 - Solution

(a)   HTML is an abbreviation for hyper text mark-up language and is used to create webpages. It uses both structure and presentation. It also uses tags to define fonts, colors, graphics and layout.

(b)   File name: ComputerSciencePapers

Protocol: http
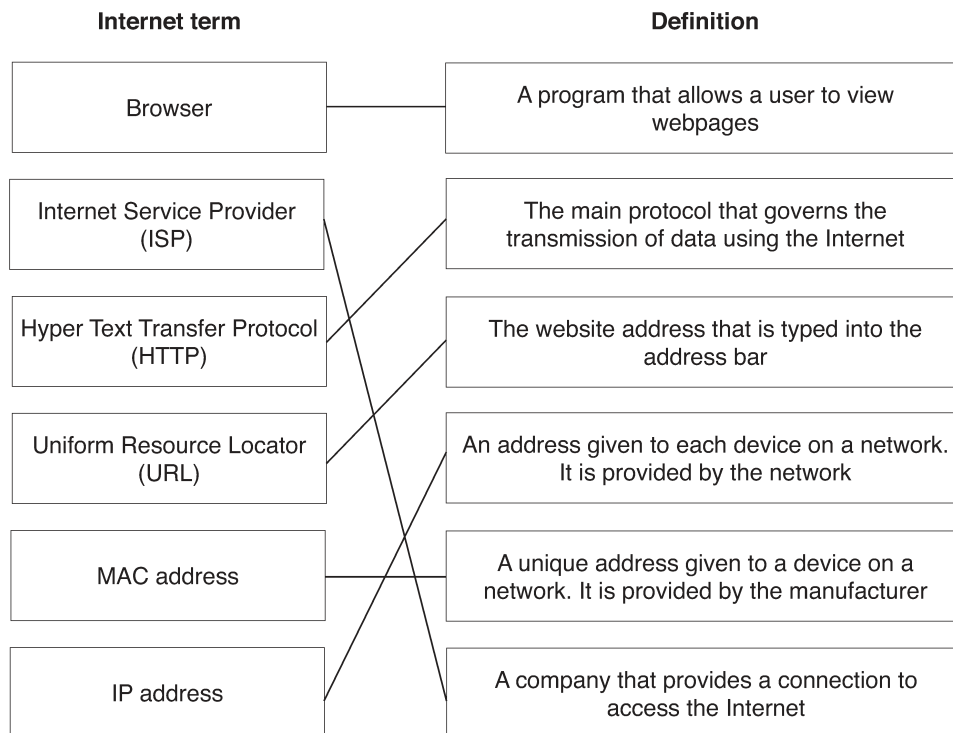
Web server name: www.cie.org.uk

Q6 - Solution

The customer uses a web browser to access the company's website. The customer enters the URL of the company's website in the address bar. The URL entered in the address bar specifies the type of protocol being used. The protocol could be Hyper Text Transfer Protocol (HTTP) or Hyper Text Transfer Protocol Secure (HTTPS). The URL also contains the domain name. Using this domain name, the Internet Service Provider (ISP) looks up the IP address of the company and the web browser sends a request to that IP address. The IP address of the company refers to the web server of the company, which holds the data for the website. When this webserver receives a request from the customer's browser, it uses the customer's IP to send the website data back to the customer's web browser. Once the data has been received back on the Customer's browser, it is transferred into Hyper Text Markup Language (HTML), which is then interpreted by the web browser to display the company's website.

Q7 - Solution

(a)   Cookies refers to files downloaded and stored onto a user's computer by the browser when a website is visited. They are designed to hold a modest amount of data specific to a client and website. They are detected when the website is visited again and can carry information from one session on a website to another.

(b)   Example 1:   To store login details

Example 2:   To store personal information / data

Teacher's Comments:

Cookies can also be used for tracking internet surfing habits, carry out targeted advertising, store payment details, customize a webpage, and store progress in online games and quizzes.

Q8 - Solution

Internet term	Definition
Browser	A program that allows a user to view webpages
Internet Service Provider (ISP)	The main protocol that governs the transmission of data using the Internet
Hyper Text Transfer Protocol (HTTP)	The website address that is typed into the address bar
Uniform Resource Locator (URL)	An address given to each device on a network. It is provided by the network
MAC address	A unique address given to a device on a network. It is provided by the manufacturer
IP address	A company that provides a connection to access the Internet

(Matching lines connect: Browser → A program that allows a user to view webpages; ISP → A company that provides a connection to access the Internet; HTTP → The main protocol that governs the transmission of data using the Internet; URL → The website address that is typed into the address bar; MAC address → A unique address given to a device on a network. It is provided by the manufacturer; IP address → An address given to each device on a network. It is provided by the network)

Q9 - Solution

(a) **Structure:** Structure refers to the layout of the webpage. e.g., placing images in a specific way alongside text on a webpage.

Presentation: Presentation refers to the formatting and/or style of the webpage. e.g., the font color and size applied to text placed on a webpage.

(b)

Statement	True (✔)	False (✔)
Cookies can be used to store a customer's credit card details	✔	
Cookies can be used to track the items a customer has viewed on a website	✔	
Cookies will corrupt the data on a customer's computer		✔
Cookies are downloaded onto a customer's computer	✔	
Cookies can be deleted from a customer's computer	✔	

(c) URL is an abbreviation for the "Uniform Resource Locator". It is a reference to a website's address and can be considered as the user-friendly version of the IP address pertaining to that website.