OCR
Oxford Cambridge and RSA

Friday 19 May 2023 – Afternoon

GCSE (9–1) Computer Science

J277/01 Computer Systems

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) MyCSTutor.co.uk

Last name Computer Science Worked Solutions

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

1 Computers represent data in binary form.

(a) Tick (✓) **one** box to identify the statement about binary that is true.

- ☐ Binary digits can only be the values 0, 1 and 2
- ☐ The left-most bit of a binary integer has the smallest value
- ☑ Binary is used because computers are made of switches that can only be on or off
- ☐ The smallest whole number that can be stored in 8 bits is the number 1

[1]

(b) Complete the table by writing the missing denary, 8-bit binary or hexadecimal values.

Denary	8-bit binary	Hexadecimal
7	128 64 32 16 8 4 2 1 00000111	7
49	00110001	31
102	01100110	66
244	11110100	F4

[4]

(c) Tick (✓) **one** box to identify the largest file size.

- ☐ 2 000 000 bytes
- ☐ 2300 KB = 2,300,000 bytes
- ☐ 200 MB = 200,000,000 bytes
- ☑ 0.1 GB = 100,000,000 bytes

[1]

(d) Tick (✓) **two** boxes to identify the two file sizes that are equal to each other.

- ☑ 4 500 000 bytes
- ☐ 450 KB
- ☑ 4.5 MB
- ☐ 0.45 GB

[1]

(e) Complete the binary addition by adding these two 8-bit binary numbers.

Show all your working.

```
  1 1 1 1
  0 1 1 1 0 0 0 1
+ 1 0 0 1 1 1 1 0
-----------------
(1) 0 0 0 0 1 1 1 1
-----------------
```

if two 1's, put 0 and carry

if three 1's, put 1 and carry

[2]

(f) Identify the binary shift that has been applied to the 8-bit binary number 10110000 to get the result 10000000.

Left Shift by 3 places

[2]

2 A student is performing a range of actions on the internet using their computer.

(a) A range of protocols are used for the transmission of data by the student's computer, and the web servers they are accessing.

(i) Complete the table by identifying the most appropriate protocol for each of the tasks the student is performing.

Task	Protocol
Requesting to view a news webpage from a web server	HTTP
Entering a username and password to access their bank account	HTTPS
Downloading a text document from a web server	HTTP
Checking for new emails in their inbox	IMAP

[4]

(ii) Some protocols have layers.

Give **two** reasons why protocols have layers.

1 .....
Separates tasks so they can operate independently
.....

2 .....
Each layer is independent - doesn't depend on each other
.....

[2]

(b) The student's computer is part of their home Local Area Network (LAN). The LAN currently only has wired connections.

(i) One characteristic of a LAN is that they are set up over a small geographical area.

Give **one** other characteristic of a LAN.

.....
Uses dedicated hardware
..... **[1]**

(ii) Describe the benefits of the student changing their home LAN to include wireless connections.

.....

Easy to set up

.....

Devices can move around - not restricted to wire

.....

No trip hazard of wires

.....

Cheaper to set up -less hardware

.....

.....

.....

..... **[4]**

(iii) State **two** drawbacks of changing their home LAN to include wireless connections.

1 .....

interference may occur

.....

less stable connection

2 .....

.....

[2]

3 Binary numbers can represent different forms of data.

(a) One form of data is characters.

Complete the description of how computers represent characters in binary using the given list of terms. Not all terms will be used.

2	4	8	9	16	32	256	
71	72	74	76	78	80	81	
all	different	identical	one	repeated	similar	some	unique

A character set stores ..... all ..... of the characters that the computer can represent. Each character is given a ..... unique ..... binary code. Lower-case and upper-case letters in a character set are given ..... different ..... binary codes.

One example of a character set is ASCII. This character set uses ..... 8 .....

bits for each character. If the code value for the character 'F' is 70 then the code value for the character 'L' is ..... 76 ..... .

[5]

(b) Binary numbers can also represent images.

The table shows the colours that are used in an image and the binary value for each colour.

Colour	Binary value
Red	0000
Green	0010
Blue	1000
Purple	0110

The metadata states that the image is 3 pixels wide by 4 pixels high.

The data in the file starts in the top left of the image and goes from left-to-right, top-to-bottom.

(i) State what is meant by **metadata** in an image file.

.....

Data about data

..... **[1]**

(ii) The binary data stored for the image is given:

00000000011010000010100001100110011000000010100 0

A grid is given for the image. Each square is one pixel.

Write the name of the colour in each square that the pixel will show for this image.

red	red	purple
blue	green	blue
Purple	Purple	purple
red	green	blue

[2]

(iii) A colour depth of 4 is used. This means 4 bits are used to store the colour for each pixel.

State the maximum number of different colours that can be represented in 4-bits.

$2^4 = 16$ ..... **[1]**

(iv) The colour depth is increased to 2 bytes.

State **two** effects that this change can have on the image.

1 greater range of colours can be represented

.....

2 image file size increases

.....

[2]

(c) A student has a text document and an image file that need to be compressed separately.

The student needs to reduce the file size of both of these files as much as possible.

(i) Identify the most suitable type of compression for the **text** document. Justify your choice.

Type of compression Lossless

Justification

We will not lose any data - the original text file can be recovered

If some data is lost, text file may be completely incomprehensable

[3]

(ii) Identify the most suitable type of compression for the **image** file. Justify your choice.

Type of compression Lossy

Justification

File size will lose quality - may not be noticed

File size will significantly reduce

[3]

4 **(a)** Tick (✓) **one or more** boxes on each row to identify all of the methods that can help to prevent each threat.

Threat	Anti-malware	Penetration testing	Encryption	Firewall
Spyware	✓			✓
Brute-force attack		✓		✓
Data interception			✓	
SQL injection		✓		✓

[4]

(b) Name **and** describe **one** threat to a computer system that is not given in **question 4(a)**.

Threat Phishing

Description

Fake email sent to person - personal information can be compromised

[3]

5 An artist has a computer that they use to create images.

Their computer has both hardware and software.

(a) The hardware includes primary and secondary storage.

(i) Explain why a computer needs both primary **and** secondary storage.

.....

Need primary to store instructions that are essential to computer eg BIOS

.....

Secondary to store files/data permanently

.....

..... **[2]**

(ii) Give **one** example of a secondary storage device that the artist's computer will have **and** an example of the data that will be stored on it.

Secondary storage device SSD .....

Example data Files .....

.....

[2]

(iii) The computer has Virtual Memory (VM).

The table has four statements about VM. Not all of the statements are correct.

Tick (✓) the **True** column for the statements that are correct.

Re-write any statement that is incorrect in the **False** column by changing the statement to make it true.

Statement	True (✓)	False – rewrite the statement to make it true
A section of primary storage is partitioned to act as virtual memory		Section of SECONDARY storage is partitioned....
Data from ROM is transferred into VM		Data from RAM is transferred into VM
VM is needed when RAM is full, or nearly full	✓	
Data from VM is transferred back to secondary storage when needed		Data from VM is transferred back to RAM when needed

[4]

(b) The computer has an operating system and utility software.

State the need for utility software in a computer.

.....

Identifies problems within a computer system

..... **[1]**

(c) The artist uploads images to be displayed on a website. This is a client-server relationship.

(i) Identify the computer that is acting as the client in this scenario **and** justify your choice.

Client computer Artists computer .....

Justification .....

Sends request to web server to upload files

.....

.....

.....

[3]

(ii) Identify the computer that is acting as the server in this scenario **and** justify your choice.

Server computer Web Server .....

Justification .....

Images are hosted on the web server, which recieves requests from client

.....

.....

.....

[3]

(d) The artist is working with a programmer on the development of a new piece of software.

The software will allow users to edit images on devices such as mobile telephones.

They are considering releasing the software as open source instead of proprietary.

(i) Describe **two** benefits to the artist and programmer of releasing the software as proprietary.

1 .....

Can earn money by using licenses to stop unauthorised use - sell software for a fee

.....

.....

.....

2 .....

Users can't access the source code - so it can't be edited / resold

.....

.....

.....

[4]

(ii) Describe **one** benefit to the users of releasing the software as open source.

.....

Users do not have to pay, can redistribute the software + edit

.....

.....

..... **[2]**

6* A shopping centre has a security system that includes CCTV cameras to record activities in the centre. The security system is being upgraded to include the use of facial recognition to identify, track the movements of and record individuals throughout the shopping centre.

Discuss the positive and negative impacts of this upgrade including:

- ethical issues
- privacy issues
- legal issues

LEGAL ISSUES:

Need to follow data protection act or company can be fined

Customers must be informed of the system

Data must be kept secure

Could be used to identify crimes being commited within the shop eg theft or assault

PRIVACY ISSUES

Customers may feel it is an invasion of privacy

Public property- can be legally recorded

Customers may not have knowledge of the system

ETHICAL ISSUES

Users feel safer - action will be taken if there is misbehaviour

Users may feel unsafe because they may feel they are being watched

Users may be unaware they are recorded - need to be informed

Users should not be impacted by the recording if they are not doing anything wrong

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[8]**

7 A car comes with many embedded systems, for example parking sensors.

Identify **one** other embedded system that could be found in a car and explain why this is an embedded system.

GPS // satnav

Example embedded system .....

Explanation .....

Dedicated microprocessor calculating routes and location

.....

.....

.....

[3]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).