



GCSE



C500U10-1

FRIDAY, 19 MAY 2023 – AFTERNOON

COMPUTER SCIENCE – Component 1

Understanding Computer Science

1 hour 45 minutes plus your additional time allowance

Surname _____

First name(s) _____

Centre Number _____

Candidate Number 0 _____

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	3	
2.	8	
3.	4	
4.	5	
5.	6	
6.	9	
7.	7	
8.	8	
9.	7	
10.	8	
11.	10	
12.	6	
13.	10	
14.	9	
Total	100	

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces provided on the front cover.

Answer ALL questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the need for good English and orderly, clear presentation in your answers.

The use of calculators is not permitted in this examination.

The total number of marks is 100.

Some questions will require you to draw on knowledge from multiple areas of your course of study.

(Turn over)

Answer ALL questions.

1 (a) State the name given to a collection of 4-bits.

[1 mark]

(b) Arrange the following data storage requirements in order.

(i) Smallest to largest. [1 mark]

2050 B

0.5 GB

2 KB

532 MB

(Turn over)

1 (b) (ii)

Largest to smallest. [1 mark]

0.01 TB

2 000 000 bits

0.26 MB

0.1 PB

CHARACTERISTIC	COMPONENT			
	MOTHERBOARD	GRAPHICS CARD	SOUND CARD	CONTROL UNIT
Ensures that all processes take place at the right time and in the correct order.				
Provides expansion slots, USB ports, PCI slots and controllers for devices such as the hard drive, keyboard and mouse.				
Convert analogue input signals into digital data and reverse this process for output.				

2 (a) Tick (✓) (on the table opposite) the component of a computer system that matches each characteristic. [3 marks]

(b) Other than enabling faster processing of data, give ONE benefit of increasing the following in a CPU.

(i) Number of cores. [1 mark]

2 (b) (ii)

Cache size. [1 mark]

2 (c) (i)

Describe an embedded system. [2 marks]

(Turn over)

2 (c) (ii)

Circle the correct name given to software written specifically for an embedded system. [1 mark]

MALWARE

FREWARE

FIRMWARE

TUPPERWARE

3. Explain how cloud storage works. [4 marks]

[illegible]

(Turn over)

4 (a) Determine the missing column headings in the truth table below. [3 marks]

<i>A</i>	<i>B</i>			
0	0	1	1	0
0	1	0	0	0
1	0	1	0	0
1	1	0	1	1

- 4 (b) Tick (✓) the correct boxes below to show the Boolean expression that represents the function described by each truth table. [1 mark]

(i)

INPUT		OUTPUT
P	Q	R
0	0	0
0	1	1
1	0	0
1	1	0

$$R = P \oplus Q$$

☐

$$R = \overline{P} \cdot \overline{Q}$$

☐

$$R = \overline{P} \cdot Q$$

☐

$$R = \overline{P} + Q$$

☐

(Turn over)

4 (b) (ii)

INPUT		OUTPUT
X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	0

$$Z = \overline{X} \cdot \overline{Y}$$

$$Z = \overline{X \oplus Y}$$

$$Z = X + Y$$

$$Z = \overline{X} + \overline{Y}$$

(Turn over)

5. Describe the following network hardware used in establishing wired and wireless connectivity.

(a) Switches. [2 marks]

5 (b) Bridges. [2 marks]

5 (c) Wireless access points (WAPs). [2 marks]

- 6 (a) Complete the table by converting between binary, denary and hexadecimal number counting systems. [3 marks]

BINARY	DENARY	HEXADECIMAL
01011111_2		$5F_{16}$
10100010_2	162_{10}	
	249_{10}	$F9_{16}$

(Turn over)

6 (b) (i)

Show how 17_{10} would be subtracted from 56_{10} using two's complementation. [4 marks]

6 (b) (ii)

Describe what would happen if the answer to Question 6 (b) (i) was attempted to be stored in a 5-bit register. [2 marks]

(Turn over)

DESCRIPTION	FORM OF CYBERATTACK			
	SHOULDER SURFING	SOCIAL ENGINEERING	TROJAN	SQL INJECTION
Tricking a user into giving out sensitive information such as a password, by posing as a legitimate system administrator.				
Altering queries to compromise the security of information held in a database.				
Using direct long distance observation with the aid of CCTV.				

7. All computer systems have vulnerabilities.

(a) Tick (✓) the boxes (on the table opposite) that match the form of cyberattack with the correct description. [3 marks]

(b) Describe the following TWO methods of identifying vulnerabilities.

(i) Network forensics. [2 marks]

7 (b) (ii)

Firewalls. [2 marks]

8. Clearly showing each step, simplify the Boolean expressions using Boolean algebra and identities.

No credit will be awarded for answers containing a truth table.

(a) $A.\bar{A} + B.(\bar{B} + C)$ [4 marks]

(Turn over)

8 (b) $X + Y.\overline{Z} + X.\overline{Y} + X.Y$ [4 marks]

(Turn over)

9. Protocols provide an agreed set of rules to allow networked devices to communicate.

(a) Give TWO advantages of a network. [2 marks]

ADVANTAGE 1:

ADVANTAGE 2:

(Turn over)

DESCRIPTION	PROTOCOL			
	SMTP	HTTP	IP	WI-FI
	A network layer communications protocol for relaying datagrams across network boundaries.			
	An Internet standard communications protocol for electronic mail transmission.			
	The protocol used to transfer multimedia webpages over a network.			

9 (b) Tick (✓) the boxes (in the table opposite) to match the protocol with the correct description.

[3 marks]

(c) Describe the application layer and physical layer in the TCP/IP 7-layer model for data transmission.

[2 marks]

APPLICATION LAYER:

9 (c) PHYSICAL LAYER:

10. Operating systems are installed with a range of utility software designed to help optimise or maintain a computer system.

(a) Complete the following sentences about utility software, using only the words given.

LOADER

LOGICAL COMPILER

DISK DEFRAGMENTERS

MALWARE INTERPRETER

DISK PARTITION EDITORS

FILE MANAGER

ANTI-VIRUS

CLIPBOARD

(i) _____ software removes any malicious code that has already infected a computer. [1 mark]

10 (a)

(ii) _____ are designed to view, create, modify or delete a logical segment of storage space. [1 mark]

(iii) Files are physically rearranged on disk so that they are no longer split using _____ . [1 mark]

(iv) A _____ allows operations such as creating, opening, renaming, copying, moving, deleting and searching documents stored on a computer system. [1 mark]

10 (b)

Describe the following utility software and how they help optimise or maintain a computer system.

(i) Disk compression. [2 marks]

(Turn over)

10 (b)

(ii) Revision control. [2 marks]

11. The storage requirements for an image can be determined by:
- multiplying the width and height of the image, in pixels, to get the total pixel count
 - multiplying the total pixel count by the colour depth to get the storage requirements.



11 (a)

Write an algorithm that outputs the storage requirements in MEGABYTES for an image.

[7 marks]

[illegible]

(Turn over)

11 (b)

Expand the algorithm to output the DISK SPACE SAVED when a lossy compression algorithm is used and has a compression ratio of 5 : 2.

[3 marks]

[illegible]

(Turn over)

```
1 r is real
2 A is real
3 pi is real
4
5 set pi = 3.14
6
7 input r
8
9 if r < 0 then
10   A = pi * r * r
11   output "Area = ", A
12 esle
13   output "You must enter a number greater than 0 for r."
14 end if
```

12. The program opposite is intended to calculate the area of a circle, but contains errors.

(a) Identify an example of each error in the program and suggest a possible correction.

(i) SYNTAX ERROR [2 marks]

ERROR: _____

LINE: _____

CORRECTION: _____

(ii) LOGICAL ERROR [2 marks]

ERROR: _____

LINE: _____

CORRECTION: _____

12 (b)

Compare how an interpreter and a compiler would have identified these errors. [2 marks]

(Turn over)

13. Describe the characteristics of the following algorithms.

(a) Bubble sort. [5 marks]

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13 (b)

Binary search. [5 marks]

(Turn over)

14. Discuss the principles of the following legislation:

- **The General Data Protection Regulation (GDPR) and Data Protection Act 2018**
- **Computer Misuse Act 1990**
- **Freedom of Information Act 2000. [9 marks]**

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(Turn over)

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