

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

C500U10-1



S23-C500U10-1



FRIDAY, 19 MAY 2023 – AFTERNOON

**COMPUTER SCIENCE – Component 1****Understanding Computer Science**

1 hour 45 minutes

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	
<b>Total</b>	<b>100</b>	

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01**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen.  
Do not use gel pen or correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

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.



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Answer **all** questions.

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

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

- (i) Smallest to largest. [1]

**2050 B**

**0.5 GB**

**2 KB**

**532 MB**

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- (ii) Largest to smallest. [1]

**0.01 TB**

**2000 000 bits**

**0.26 MB**

**0.1 PB**

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

Characteristic	Component			
	Motherboard	Graphics Card	Sound Card	Control Unit
Ensures that all processes take place at the right time and in the correct order.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provides expansion slots, USB ports, PCI slots and controllers for devices such as the hard drive, keyboard and mouse.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Convert analogue input signals into digital data and reverse this process for output.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

(i) Number of cores.

[1]

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(ii) Cache size.

[1]

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(c) (i) Describe an embedded system.

[2]

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(ii) Circle the correct name given to software written specifically for an embedded system.

[1]

**MALWARE**

**FREWARE**

**FIRMWARE**

**TUPPERWARE**

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3. Explain how cloud storage works.

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

<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

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

(i)

Input		Output
<i>P</i>	<i>Q</i>	<i>R</i>
0	0	0
0	1	1
1	0	0
1	1	0

$$R = P \oplus Q$$

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

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

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





(ii)

[1]

Input		Output
$X$	$Y$	$Z$
0	0	1
0	1	0
1	0	0
1	1	0

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

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

$$Z = X + Y$$

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



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

(a) Switches. [2]

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(b) Bridges. [2]

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

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

Binary	Denary	Hexadecimal
$01011111_2$		$5F_{16}$
$10100010_2$	$162_{10}$	
	$249_{10}$	$F9_{16}$

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- (b) (i) Show how  $17_{10}$  would be subtracted from  $56_{10}$  using two's complementation. [4]

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

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7. All computer systems have vulnerabilities.

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

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.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Altering queries to compromise the security of information held in a database.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using direct long distance observation with the aid of CCTV.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(b) Describe the following **two** methods of identifying vulnerabilities.

(i) Network forensics. [2]

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(ii) Firewalls. [2]

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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)  $A \cdot \bar{A} + B \cdot (\bar{B} + C)$  [4]

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(b)  $X + Y \cdot \bar{Z} + X \cdot \bar{Y} + X \cdot Y$  [4]

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

(a) Give **two** advantages of a network. [2]

**Advantage 1:** .....

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**Advantage 2:** .....

.....

(b) Tick (✓) the boxes to match the protocol with the correct description. [3]

Description	Protocol			
	SMTP	HTTP	IP	Wi-Fi
A network layer communications protocol for relaying datagrams across network boundaries.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
An Internet standard communications protocol for electronic mail transmission.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The protocol used to transfer multimedia webpages over a network.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





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(c) Describe the application layer and physical layer in the TCP/IP 7-layer model for data transmission. [2]

**Application layer:** .....

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**Physical layer:** .....

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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.

<b>LOADER</b>	<b>LOGICAL COMPILER</b>	<b>DISK DEFRAGMENTERS</b>	<b>MALWARE INTERPRETER</b>
<b>DISK PARTITION EDITORS</b>	<b>FILE MANAGER</b>	<b>ANTI-VIRUS</b>	<b>CLIPBOARD</b>

- (i) ..... software removes any malicious code that has already infected a computer. [1]
- (ii) ..... are designed to view, create, modify or delete a logical segment of storage space. [1]
- (iii) Files are physically rearranged on disk so that they are no longer split using ..... [1]
- (iv) A ..... allows operations such as creating, opening, renaming, copying, moving, deleting and searching documents stored on a computer system. [1]



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

(i) Disk compression. [2]

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(ii) Revision control. [2]

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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.



(a) Write an algorithm that outputs the storage requirements in **megabytes** for an image. [7]

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(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]

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

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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

```

(a) Identify an example of each error in the program and suggest a possible correction. [2]

(i) **Syntax Error**

[2]

**Error:** ..... **Line:** .....

**Correction:** .....

(ii) **Logical Error**

[2]

**Error:** ..... **Line:** .....

**Correction:** .....

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

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13. Describe the characteristics of the following algorithms.

(a) Bubble sort.

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(b) Binary search.

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**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.

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Question number	<b>Additional page, if required. Write the question number(s) in the left-hand margin.</b>

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