



GCSE



C500U10-1

WEDNESDAY, 15 MAY 2024 – 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.	9	
2.	3	
3.	7	
4.	8	
5.	8	
6.	4	
7.	9	
8.	6	
9.	8	
10.	10	
11.	6	
12.	8	
13.	6	
14.	8	
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)

DESCRIPTION	COMPILATION STAGE			
	LEXICAL	SYNTAX	SEMANTIC	CODE GENERATION
This stage involves scanning the source code character-by-character and tokenising it based on language rules and patterns.				
This stage examines a program's meaning and determines if it adheres to the norms and rules of the programming language being used.				
This stage examines a series of tokens to see if they adhere to the language's grammar rules. It is also known as parsing.				

Answer ALL questions.

1 (a). Tick (✓) the compilation stage that matches the description on the table opposite. [3 marks]

(b) Describe TWO different types of programming error. [6 marks]

ERROR 1:

(Turn over)

1 (b)

ERROR 2:

- 2 (a) State the LOGICAL OPERATOR that has been used to produce the output in the following truth table. [1 mark]

INPUT		OUTPUT
A	B	
0	0	0
0	1	1
1	0	1
1	1	1

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

(i)

INPUT		OUTPUT
R	S	
0	0	0
0	1	0
1	0	1
1	1	0

 $R.S$ ☐ $\overline{R + S}$ ☐ $R.\overline{S}$ ☐ $R + S$ ☐

(ii)

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

 $X.Y$ ☐ $\overline{X + Y}$ ☐ $X + Y$ ☐ $\overline{X.Y}$ ☐

(Turn over)

CHARACTERISTIC	TECHNOLOGY			
	OPTICAL	VIRTUAL	MAGNETIC	MAGNETIC
A remote data storage service accessed over the internet.				
The use of laser technology to store and retrieve data on discs such as CDs, DVDs, and Blu-ray.				
A type of data storage technology that stores information on rotating disks or tapes.				

3. Secondary storage technology is used for the long-term storage of data.

(a) Tick (✓) the secondary storage technology that matches the characteristic in the table opposite.

[3 marks]

(b) Describe the functional characteristics of solid-state storage. [4 marks]

[illegible]

(Turn over)

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

DO NOT USE TRUTH TABLES IN YOUR ANSWER.

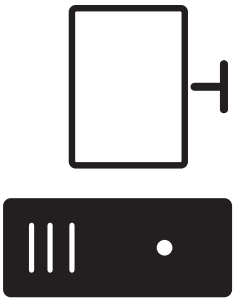
(a) $X.(0 + X) + Y.(1 + X)$ [3 marks]

(Turn over)

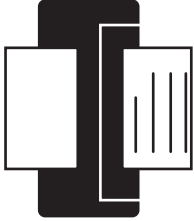
4 (b) $B.(B + A) + A.(B + A)$ [5 marks]

[illegible]

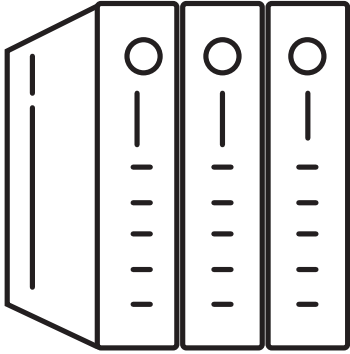
(Turn over)



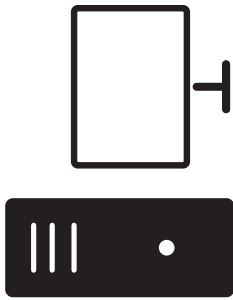
Workstation



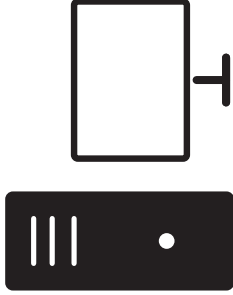
Printer



Switch



Workstation



Workstation

5. A small organisation has only one office.

(a) The organisation uses a star topology.

(i) Draw lines between the devices opposite to show this topology: [1 mark]

(ii) Give THREE advantages of a star topology. [3 marks]

ADVANTAGE 1: _____

5 (a) (ii)

ADVANTAGE 2: _____

ADVANTAGE 3: _____

(Turn over)

5 (b) Name and state the purpose of TWO protocols that this network may use for communication.

[4 marks]

PROTOCOL 1: _____

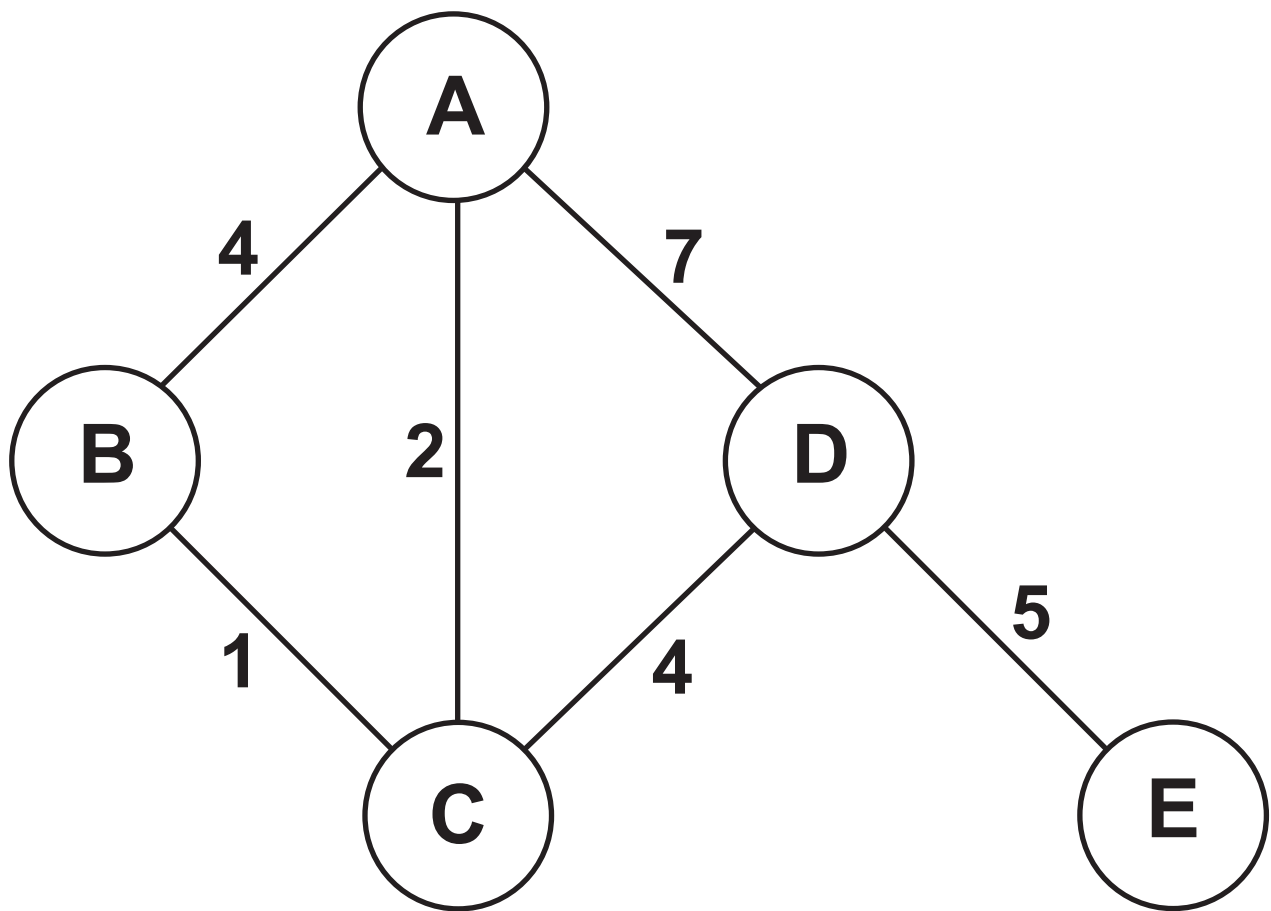
PURPOSE: _____

5 (b)

PROTOCOL 2: _____

PURPOSE: _____

(Turn over)



6. The diagram opposite shows the routing cost between each node for data transmitted on a certain network.

Complete the table, indicating the lowest cost routes from node **A** to each destination.

[4 marks]

DESTINATION	LOWEST COST	ROUTE
B		
C		
D		
E		

(Turn over)

7 (a) Convert the following numbers into hexadecimal.

(i) 183_{10} [1 mark]

7 (a) (ii)

01001011_2 [1 mark]

28_{10}	115_{10}	Carry	Answer

- 7 (b) Complete the table opposite to calculate the binary addition of 28_{10} to 115_{10} using an 8-bit register. [4 marks]
- (c) Using a suitable binary addition example, demonstrate the concept of overflow. [3 marks]

[illegible]

(Turn over)

8. Describe, using an example, the design of one-dimensional and two-dimensional arrays.
[6 marks]

ONE-DIMENSIONAL ARRAYS:

8. TWO-DIMENSIONAL ARRAYS:

- 9. An IDE (Integrated Development Environment) is a software application that provides comprehensive help for software development.**
- (a) Complete the sentences opposite about IDE tools using only the words given below.**

LINKER

EDITOR

DEBUGGER

MEMORY INSPECTOR

TRACE

BRIDGE

LOADER

STATEMENT COMPLETION

9 (a)

(i)

is a facility which displays the order in which the lines of a program are executed, and possibly the values of variables as the program is being run.

[1 mark]

(ii)

is a program which helps locate, identify and rectify errors in a program. [1 mark]

(iii) A program which allows previously compiled code, from software libraries, to be joined together is called a

[1 mark]

(iv)

is a context-aware feature that speeds up the process of writing code by reducing typos and other common mistakes. [1 mark]

(Turn over)

9 (b) Describe the following IDE tools and how they help when writing a program.

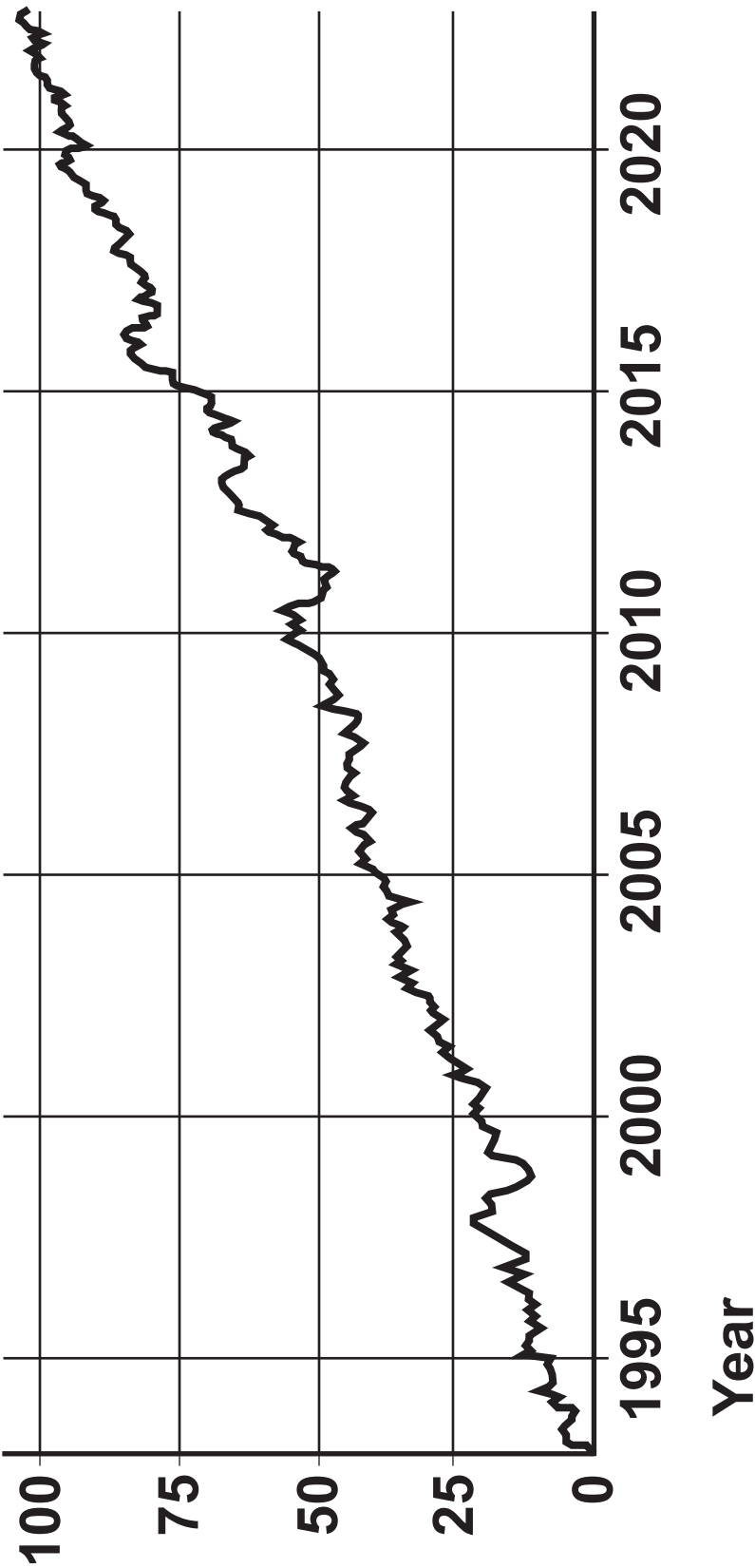
(i) Break point. [2 marks]

9 (b) (ii)

Variable watch. [2 marks]

(Turn over)

Sea Height Variation (mm)



Source: climate.nasa.gov

10. **Sea levels have risen over 100 mm since 1993. Satellites record changes to the sea level every month, in mm, and then use a computer system to analyse the data opposite.**

Write an algorithm, using pseudo-code, that will assist this analysis. [10 marks]

Your algorithm should:

- **input and validate a series of sea level changes from month-to-month**
- **output the total change in sea level over time**
- **output the mean sea level change**
- **output the largest monthly increase**
- **output the smallest monthly increase.**

For example:

INPUTS

Enter reading: **0.20**

Enter reading: **0.18**

Enter reading: **0.08**

Enter reading: **0.24**

Enter reading: **0.22**

OUTPUTS

Total change over time = **0.92 mm**

Number of readings = **5**

Mean change = **0.184 mm**

Largest increase = **0.24 mm**

Smallest increase = **0.08 mm**

11. Describe the purpose and typical contents of a formal code of conduct for employees of an organisation. [6 marks]

[illegible]

CHARACTERISTIC	INTERFACE			
	GUI	CLI	VOICE-DRIVEN	MENU-DRIVEN
An interface with an ability to respond to natural language input in real-time.				
An interface that allows for user interaction through the use of visual elements, such as buttons and icons.				
An interface that can often involve a non-graphical way of inputting and receiving information.				

12. The operating system is a suite of system programs that manages a computer's resources.

(a) Tick (✓) the interface that matches the characteristic provided by an operating system on the table opposite. [3 marks]

(b) Explain how the operating system manages:

(i) the CPU. [2 marks]

12 (b) (ii)

interrupts. [3 marks]

13. Discuss the principles of the following legislation:

(a) Regulation of Investigatory Powers Act 2000.

[3 marks]

(Turn over)

13 (b)

Telecommunications Regulations Act 2000.

[3 marks]

(Turn over)

GAMING PC 1	GAMING PC 2
 A black mid-tower gaming PC case with a transparent side panel, showing internal components including a motherboard, RAM, and a power supply. The front panel features two large, illuminated circular fans.	 A black mid-tower gaming PC case with a transparent side panel, showing internal components including a motherboard, RAM, and a power supply. The front panel features two large, illuminated circular fans.
• Intel Core i9 13900 KF (12 Cores up to 3.40 GHz, 16MB Cache) • 16GB RAM, 500GB SSD • NVIDIA GeForce RTX 4080 • Wi-Fi, Windows 11 Home • 3 Year Warranty.	• AMD Ryzen 9 7950 X (8 Cores up to 4.20 GHz, 20MB Cache) • 8GB RAM, 1TB HDD • NVIDIA GeForce RTX 4080 • Wi-Fi, Windows 11 Home • 3 Year Warranty.

14. Good friends, Rhys and Alex, are considering buying a new gaming PC each.

They are discussing the two specifications that are on the opposite page.

Assuming that you have joined this discussion, explain your understanding when comparing the performance and features of the TWO PC specifications opposite. [8 marks]

END OF PAPER

(Turn over)

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

(Turn over)

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