Surname	Centre Number	Candidate Number
First name(s)		2

GCE AS/A LEVEL

2500U10-1

S23-2500U10-1

TUESDAY, 16 MAY 2023 – AFTERNOON

COMPUTER SCIENCE – AS unit 1
Fundamentals of Computer Science

2 hours

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

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ADDITIONAL MATERIALS

A calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer **all** questions.

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

Write your answers in the spaces provided in this booklet. If you run out of space, use the continuation pages 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.

The total number of marks available is 100.

Assessment will take into account the quality of written communication used in your answers.

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Answer **all** questions.

1. (a) Complete the table. [6]

Data Type	Example Data	Storage Requirements (in bits)
Character (ASCII)		b
Boolean		b
Short Integer		b

(b) Describe how character sets are used in a computer system. [2]

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2. A certain single-core processor will process the following calculation in seven steps:

$$Y = (4 \times 5) + (1 \times 6) + (5 \times 3) + (3 \times 2)$$

Step 1: $Y = 20 + (1 \times 6) + (5 \times 3) + (3 \times 2)$
Step 2: $Y = 20 + 6 + (5 \times 3) + (3 \times 2)$
Step 3: $Y = 20 + 6 + 15 + (3 \times 2)$
Step 4: $Y = 20 + 6 + 15 + 6$
Step 5: $Y = 26 + 15 + 6$
Step 6: $Y = 41 + 6$
Step 7: $Y = 47$

(a) (i) Describe, showing each step, how a quad-core processor would process the calculation. [3]

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(ii) State the name given to this method of processing data. [1]

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(b) Identify and state the purpose of **four** components in a CPU. [4]

Component 1

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Component 2

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Component 3

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Component 4

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3. The following data is stored in an 8 bit register:

1	0	1	1	1	0	0	0

Demonstrate how the state of the most significant bit can be determined using a logical operation. [3]

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4. (a) Explain, with reference to the functional characteristics of a Hard Disk Drive (HDD), how performance is affected by data fragmentation. [6]

(b) Describe how the effect of fragmentation can be reduced on a HDD. [3]

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5. (a) State what is meant by the term handshaking. [1]

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(b) Explain the importance of having networking standards. [3]

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(c) Name **two** standard networking protocols and describe their function and importance. [6]

Protocol 1

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Protocol 2

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6. Describe simplex, half duplex and full duplex data transmission methods and give an example use for each. [6]

Simplex

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Half duplex

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Full duplex

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7. The area and circumference of a circle can be calculated using the following formulae:

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Area of a circle	**Circumference of a circle**
$A = \pi r^2$	$C = 2\pi r$

Where $\pi = 3.14$ and r = *radius*.

Write an algorithm, using pseudo-code, which will allow a user to enter the radius to calculate the area and circumference of a circle. The values input should be in metres, but the output should be converted into centimetres ($1\,m^2 = 10{,}000\,cm^2$ and $1\,m = 100\,cm$).

For example:

Input	**Output**
r = 1.5 (metres)	A = 70650 cm^2 C = 942.0 cm

Your algorithm should output a suitable error message if the value entered is not valid.

Your algorithm should be written using self-documenting identifiers. [8]

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8. Clearly showing each step, simplify the following expression using only Boolean identities and rules:

$$Q.(P+Q)+\overline{P}.(1+R)+Q.(\overline{P}.P)$$ [7]

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9. (a) The following data is stored in `myArray`.

`myArray`

1	2	5	6	8	11	14
(0)	(1)	(2)	(3)	(4)	(5)	(6)

Write down the order in which each number will be accessed when performing the following types of search for **14**.

You may not need to use all the boxes given.

(i) Linear search. [2]

1st	2nd	3rd	4th	5th	6th	7th

(ii) Binary search. [2]

1st	2nd	3rd	4th	5th	6th	7th

(b) Give **one** advantage and **one** disadvantage of a binary search over a linear search. [2]

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10. Describe the principles of data compression algorithms. [6]

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11. (a) Describe the term data structure and why data structures are used in computing. [2]

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(b) Information about films is stored in a table.

FilmID	Title	Certificate	Genre
1	End in Justice	18	Horror
2	Inferno of Retaliation	12	Action
3	Mission Mercury	15	Sci-fi
4	Boy of an Angel	PG	Romcom
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Describe each of the following using examples from the table:

(i) Field. [2]

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(ii) Record. [2]

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(iii) Primary key. [2]

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12. Describe sequential files and how records are added to them. [6]

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13. Describe, giving an example, **one** type of maintenance performed on a computer program. [3]

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14. Andrew is considering using three different methods for storing **positive** numbers, using two's complementation, in a computer system.

METHOD 1	METHOD 2	METHOD 3
Store numbers as an integer using an 8 bit register.	Store real numbers in normalised floating-point form, using a 5 bit mantissa and a 3 bit exponent.	Store real numbers in normalised floating-point form, using a 4 bit mantissa and a 4 bit exponent.

Calculate the denary range (highest and lowest) of numbers that can be stored by each method. Compare the advantages of representing numbers in integer and floating-point forms.
[12]

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END OF PAPER

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Turn over.

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