Surname	Centre Number	Candidate Number
First name(s)		2

GCE AS

B500U10-1

020-B500U10-1

WEDNESDAY, 7 OCTOBER 2020 – MORNING

COMPUTER SCIENCE – AS component 1
Fundamentals of Computer Science

2 hours

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

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ADDITIONAL MATERIALS

A calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball point pen.

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 continuation page 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 total number of marks available is 100.

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Answer **all** *questions.*

1. *(a)* Determine the Boolean expression that is described by each of the following truth tables.

(i)

Input		Output
A	**B**	**C**
0	0	1
1	0	0
0	1	0
1	1	0

[1]

.....

(ii)

Input		Output
X	**Y**	**Z**
0	0	1
1	0	1
0	1	0
1	1	1

[1]

.....

(b) Draw a truth table for the following Boolean expression:

$$P = \overline{Q} + (R.\overline{S})$$

[3]

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2. *(a)* Describe how cache memory is used in a Central Processing Unit (CPU). [4]

(b) Describe parallel processing and its limiting factors. [5]

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3. *(a)* Describe serial transmission and parallel transmission and give one advantage for each transmission type. [4]

(b) Describe simplex, half duplex and full duplex transmission methods and give an example of each. [6]

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4. The following algorithm determines the highest mark from a series of marks input by a teacher.

```
1   set highest = 0
2
3   loop
4      input mark
5
6      if mark > highest then
7         set highest = mark
8      endif
9
10  until (mark < 0 OR highest = 100)
11
12  output "The highest mark is ", highest
```

An example of a programming construct in the above algorithm is a sequence of instructions.

Identify three other programming constructs used above and state their purpose in this algorithm. [6]

Construct 1: ..... **Line:** .....

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Construct 2: ..... **Line:** .....

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Construct 3: ..... **Line:** .....

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5. *(a)* Determine the highest and lowest numbers that can be stored in an 8 bit register using:

(i) two's complementation. [4]

(ii) sign and magnitude. [2]

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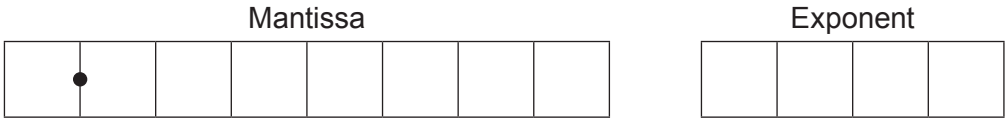
(b) In a certain computer system, real numbers are stored in floating point form using two's complementation, an 8 bit mantissa and a 4 bit exponent.



Showing your working, calculate the largest positive denary number that this computer system can store. [3]

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6. Clearly showing each step, simplify the following Boolean expression using Boolean algebra and identities: [7]

$$X.(Y+X)+\overline{X}.(\overline{Y}+Y)+Z.(Y+\overline{Z})$$

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7. *Parkwood Vale Primary School* wants to create a computer program for its pupils which allows the user to input a number between 1 and 10 inclusive and output the corresponding times table.

For example:

Input: 6

Output:
1 × 6 = 6
2 × 6 = 12
3 × 6 = 18
4 × 6 = 24
5 × 6 = 30
6 × 6 = 36
7 × 6 = 42
8 × 6 = 48
9 × 6 = 54
10 × 6 = 60
11 × 6 = 66
12 × 6 = 72

Write an algorithm, using pseudo-code, which will assist *Parkwood Vale Primary School* in creating this program.

As this program will be used by young children, you should take particular note of the formatting used in the output above and also create a suitable validation check(s) to ensure that the data entered by the pupils is reasonable. [7]

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8. Arrays and records are types of data structure.

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

(b) An organisation keeps data about the sales of its products on a computer system.

(i) State the essential features of an array and give one example of a situation where the organisation might use a two-dimensional array in connection with the sales of its products. [3]

(ii) Describe the term record and give one example of a situation where the organisation might use a record in connection with its products. [3]

Examiner only

9. The following data is stored in `myArray`.

`myArray`

1	4	5	6	8	10	11
(0)	(1)	(2)	(3)	(4)	(5)	(6)

`SearchValue` = 8

(a) Explain how the following search algorithms would work with `myArray` when searching for `SearchValue`.

(i) Linear search. [3]

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(ii) Binary search. [4]

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(b) Give two conditions where a linear search would be preferred to a binary search. [2]

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10. A software developer is writing new software that will go on sale later this year. Before this can happen, the software will need to go through various stages of testing.

Compare the alpha and beta testing stages and give the advantages of each. [8]

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11. Describe object-oriented programming. [4]

12. Explain the benefits of using expert systems. [6]

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13. Describe networks and explain how they communicate. [12]

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END OF PAPER

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For continuation only.