GCE A LEVEL

A500U10-1

S23-A500U10-1

MONDAY, 12 JUNE 2023 – AFTERNOON

COMPUTER SCIENCE – A level component 1
Programming and System Development

2 hours 45 minutes

A500U101
01

ADDITIONAL MATERIALS

A WJEC pink 16-page answer booklet.

INSTRUCTIONS TO CANDIDATES

Answer **all** questions.

Write your answers in the separate answer booklet provided.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question; you are advised to divide your time accordingly.

The total number of marks available is 100.

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

Answer **all** questions.

1. (a) Define the term algorithm. [2]

(b) Describe **one** method of defining algorithms. [2]

2. Clearly showing each step, simplify the following Boolean expressions using Boolean algebra, identities and De Morgan's Law.

(a) $(X + Z).(\overline{Z + X})$ [6]

(b) $B.(A + C).A.(A + C)$ [4]

3. Giving suitable examples, describe the typical contents of the following:

(a) User documentation [4]

(b) Maintenance documentation [4]

4. Draw a truth table to prove or disprove the following Boolean rules:

(a) $A + B = \overline{A}.\overline{B}$ [4]

(b) $A + 0 = A.1 = A + A = A.A$ [4]

5. This algorithm conducts basic statistical analysis on a one dimensional array producing the maximum value, minimum value, sum, mean, number of values and range. The array has been populated with floating point numbers:

```
Algorithm Stats

declare total as float
declare max as float
declare min as float
declare i as integer
declare myArray[n] as float[]

set total = 0.0
set max = myArray[0]
set min = myArray[0]
set i = 1

do
      if (myArray[i] < min) then
            set min = myArray[i]
      elseif (myArray[i] > max) then
            set max = myArray[i]
      end if
      set total = total + myArray[i]
      set i = i + 1

while (i < n)

output “Maximum Value: ” , max
output “Minimum Value: ” , min
output “Mean: ” , (total/n)
output “Range: ” , (max – min)
output “Number of Values: ” , n
output “Sum: ” , total
```


(a) Evaluate the efficiency of the search algorithm and using Big O notation, determine the growth rate for time performance. [5]

(b) Determine the rate of memory space used during a single run of the algorithm. [2]

(c) Identify the type of time complexity and draw a graph of the algorithm above to illustrate the order of time performance. Graph paper is not required. [4]

6. Manufacturers use the European Article Number (EAN-13) standard for barcoding products. Each EAN-13 barcode comprises a country code, manufacturer code, product code and check digit. All EAN-13 barcodes are 13 digits long separated using hyphens (-).

- Country codes are within the range 000 to 999.
- Manufacturers' codes are between 1 and 5 digits.
- Product codes have a varying number of digits depending on the size of the manufacturer's code.
- A check digit which could be either 1 or 3.

Example: 500-123-123456-1 or 476-19714-4444-3

(a) Produce a Backus-Naur Form (BNF) definition for an EAN-13 barcode. [5]

(b) Produce an appropriate syntax diagram to define an EAN-13 barcode. [4]

7. A presentation software application uses a linked list to store each of its slides. The software application also stores each edit a user makes allowing them to undo their actions.

(a) Draw a representation of a linked list tree using suitable example values. [2]

(b) Explain why inserting slides in a linked list is more effective than using an array. [3]

(c) Other than an array or linked list, select an appropriate data structure to store edits made to a slide and explain how this data structure operates. [4]

8. Describe the social and economic changes occurring as a result of developments in computing and computer use, and their moral, ethical, legal, and cultural consequences. [8]

9. Giving examples, explain the term data compression and describe how data compression algorithms are used. [6]

10. Write an Insertion Sort algorithm in pseudo-code that will sort the contents of a one-dimensional string array (`myArray`) into ascending order. [9]

11. Describe the processes carried out during the lexical, syntax and semantic analysis stages of compilation. [6]

12. Discuss the possible effects of computers on the nature of employment in the computing industry and wider society.

You should draw on your knowledge, skills and understanding from a number of areas across your computer science course when answering this question. [12]

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