GCE A LEVEL

A500U10-1

Z22-A500U10-1

MONDAY, 13 JUNE 2022 – 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) Explain, giving a suitable example, the operation of a hash table data structure. [4]

(b) This is a graphical representation of a one-dimensional array:

snowfall_dataset[ ]

0	1	2	3	4	5	6	7	8	9
1.63	2.45	5.75	2.35	6.34	2.45	0.89	9.23	1.53	4.56

(i) Describe what would happen if an attempt was made to insert an item of data at snowfall_dataset[10]. [2]

(ii) Explain why a one-dimensional array is suitable for storing the data in the snowfall_dataset. [2]

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

(a) $\overline{B}.(C + A.B) + \overline{B}.(A + C)$ [5]

(b) $\overline{\overline{A.B}.B} + \overline{\overline{C}}$ [5]

3. Below is an algorithm that draws a triangle.

```
Algorithm

i is integer
j is integer
k is integer
n is integer

input n

for i = 0 to n
     set j = n

     while j > i
          output " "
          set j = j - 1
     end while

     set k = n

     while k >= n - i
          output "I"
          set k = k - 1
     end while
next i
```

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

(b) Draw a graph of the algorithm above to illustrate its order of time efficiency. Graph paper is not required. [4]

(c) Determine the growth rate of memory use during a single run of the algorithm. [2]

4. Below is an algorithm.

```
Algorithm StraightLine

declare function straightLine(m,x,b)
     y is real

     startfunction
           set y = (m * x) + b
           return y
     endfunction

declare function inputVal()
     x is real

     startfunction
           output "enter x: "
           input x
           return x
     endfunction

start
     m is real
     x is real
     b is real
     m = inputVal()
     x = inputVal()
     b = inputVal()
     output straightLine(m,x,b)
end
```

(a) Describe the lifetime of variable `m` in the function straightLine. [2]

(b) Describe the scope of variable `y`. [2]

5. Explain how current computer security legislation protects businesses, individual users and national security. [8]

6. Describe the purpose of the following mathematical operations in algorithms.

(a) DIV [2]

(b) MOD [2]

(c) Below is an algorithm that makes use of the MOD operator.

```
1  Algorithm FindNums
2
3  declare myArray[] as integer[]
4  i is integer
5  count is integer
6  set i = 0
7
8  while(i < len(myArray))
9        if (myArray[i] MOD 2) = 1 then
10             set count = count + 1
11       end if
12       set i = i + 1
13 endwhile
14 output count
```

(i) Explain the purpose of the algorithm. [2]

(ii) Explain the use of sequence in the algorithm. [2]

(iii) Explain the use of selection in the algorithm. [2]

7. A festival ticket supplier produces a unique ticket validation code with each ticket purchase. This validation code comprises four parts: the buyer's surname, the digits from their postcode, an ID and a randomly generated hexadecimal value. Each part is separated with chevrons (»).

- The surname can only contain uppercase letters.
- The postcode can only contain digits.
- The ID must contain 6 digits.
- The hexadecimal value uses digits and / or uppercase letters and can be of any length.
- Chevrons (»).

Example: ZAKS»63»300700»4BAF76C2D7

Produce a Backus-Naur Form (BNF) definition for the validation code. [6]

8. Explain the use of program version management in software engineering. [8]

9. A local shop has approached a software company to build a web application with the following requirements:

- To display all the products they have in store through a modern user interface (UI).
- To allow customers to find and filter products through the web application.
- To allow staff to login and create, edit, delete and view products through a back-end database.

Explain why it will be important to analyse these requirements using decomposition and abstraction. [6]

10. Write a Bubble Sort algorithm in pseudo-code that will sort the contents of a one-dimensional integer array (myArray) into descending order. [9]

11. Explain the ambiguities in natural language syntax compared with computer language syntax. [8]

12. Discuss the importance of promoting professional behaviour given the social changes that have occurred as a result of developments in computing and computer use.

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

END OF PAPER