



**GCE A LEVEL**

A500U10-1



**COMPUTER SCIENCE – A level component 1**  
**Programming and System Development**

MONDAY, 3 JUNE 2019 – MORNING

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) Describe the differences between high-level and low-level languages. [4]  
 (b) Describe **one** situation that would require the use of a low-level language. [2]
  
2. Below is an algorithm that outputs duplicate values in a one-dimensional array (myArray).

```

Algorithm Duplicates

i is integer
j is integer

for i = 0 to len(myArray)- 2
    for j = i + 1 to len(myArray)- 1
        if (myArray[i] = myArray[j])
            output "Duplicate found: " , myArray[i]
        end if
    next j
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. [3]
- (c) Determine the growth rate of memory space during a single run of the algorithm. [2]
  
3. Clearly showing each step, simplify the following Boolean expressions using Boolean algebra, identities and De Morgan's Law.
  - (a)  $\overline{A}.A + A.B + \overline{A}.B$  [5]
  - (b)  $A. (B + B) + A. (\overline{A} + \overline{B})$  [5]
  
4. Describe the use of alpha, beta and acceptance testing. [6]

5. (a) Explain the purpose of procedures in algorithms. [4]
- (b) Explain what is meant by parameter passing by reference and by value. [4]

Below is an algorithm.

```

Algorithm Trapezium

declare function trapeziumArea(x,y,z)
TArea is real

startfunction
    set TArea = ((x + y) * z) * 0.5
    return TArea
endfunction

declare subprocedure MainProg
a is real
b is real
h is real

area is real

startprog
    output "Enter length of first side: "
    input a
    output "Enter length of second side: "
    input b
    output "Enter height: "
    input h
    area = trapeziumArea(a,b,h)
    output "The area is " + area
endprog

start
    call MainProg
end

```

- (c) Describe the lifetime of variable TArea. [2]
- (d) Describe the scope of variable a. [2]
6. Draw a truth table to prove the distributive law:  
 $A \cdot (B + C) = (A \cdot B + A \cdot C)$  [6]

7. Two eight-bit numbers are:

**X** 01011011

**Key** 11001110

Include these two numbers in a worked example to explain how the XOR operation can be used for encrypting data. You should also show how the original data can be recovered. [3]

8. A loyalty card system in a large department store uses a unique loyalty card code for each customer. The loyalty card code comprises the Customer's ID followed by a hyphen followed by year of birth and the customer type. E.g. AF154785-2000S.

- The Customer ID comprises at least two letters followed by six digits
- Hyphen (-)
- The year of birth is within the range 1900 – 2200
- Customer type comprises a single letter: 'S' for Standard, 'V' for VIP or 'C' for Concession
- All letters are uppercase

Produce a Backus-Naur Form (BNF) definition for the loyalty card number. [5]

9. Write an insertion sort algorithm in pseudo-code that will sort the contents of a one-dimensional integer array (myArray) into ascending order. [7]

10. (a) Giving an example, explain the purpose of validation. [2]

(b) Giving an example, explain the purpose of verification. [2]

11. Using examples describe the differences between translation and execution errors. [4]

12. (a) Describe a queue data structure. [2]

(b) The following people are in an online virtual queue for concert tickets:

Gita, Sam, Huw, Tariq, Joy, Fred, Kacpar and Claire.

(i) Draw a clearly labelled diagram to show how the above queue can be represented using a one-dimensional array and pointers. [3]

(ii) Write an algorithm to remove a person from the queue or identify if the queue is empty. [2]

13. A stock control system stores details of products in a binary tree structure. The tree structure uses 5-digit product IDs as key values.
- (a) Draw a representation of the binary tree using the following key values in the order below:  
11114, 11134, 11126, 11121, 11110, 11113, 11111 [3]
  - (b) Show how the above binary tree can be represented using a two-dimensional array. [3]
  - (c) Redraw the tree with 11110 deleted. [1]
14. Explain how current legislation impacts on private data and what measures can be taken to protect this data.
- You should draw on your knowledge, skills and understanding from a number of areas across your computer science course when answering this question. [13]

**END OF PAPER**

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