GCE A LEVEL

1500U30-1

S23-1500U30-1

MONDAY, 12 JUNE 2023 – AFTERNOON

COMPUTER SCIENCE – A2 unit 3
Programming and System Development

2 hours

1500U301
01

ADDITIONAL MATERIALS

A WJEC pink 16-page answer booklet.
A calculator.

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

Answer **all** questions.

1. (a) Explain the operation of a hash table. [4]

(b) This is a diagram of a hash table:

Key	Value
1001	Apple
1002	Berry
1003	Kiwi
1004	Lime
1005	Mango
1006	Pear
1007	Pineapple

(i) Redraw the hash table after “1008, Orange” has been added and “1003, Kiwi” has been deleted. [2]

(ii) Starting from the modified hash table resulting from (b)(i) redraw the hash table after “1006, Peach” has been added. [2]

2. Explain the differences between procedural and object orientated programming paradigms, giving suitable examples for each. [8]

3. Using the following Truth Table express *p* as a Boolean expression:

A	*B*	*C*	*p*
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

[4]

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

(a) $A.(1+C)+\overline{B}.(A+B)$ [5]

(b) $X.\left(\overline{Y+Z}\right)+\overline{Z}.X$ [5]

5. Write a quicksort algorithm, to sort an array of integers into ascending order. [8]

6. State the purpose of validation and verification, giving a suitable method for each. [4]

7. An online grocery store uses binary trees. These binary trees can be traversed using a variety of methods.

(a) Describe the following methods of traversal and give an example of why each method would be used in the grocery store.

(i) In-order traversal [3]

(ii) Post-order traversal [3]

(iii) Pre-order traversal [3]

(b) Draw an example of a balanced binary tree for grocery items. [1]

8. Giving suitable examples, describe the types of software tool that have been designed to assist in the following:

(a) Analysis and planning [3]

(b) Software development [3]

(c) Version management [3]

9. A QR code generator uses a string to produce a WiFi access QR code. The string comprises the QR code type, encryption type, network name (SSID) and password. The string is separated using colons.

- The QR code type is WIFI.
- Colon (:)
- Encryption can be either WEP or WPA.
- The network name can contain only lowercase letters, uppercase letters and digits.
- The password can contain lowercase letters, uppercase letters, special characters and digits.

Example: WIFI:WEP:WJECWiFiPublic:Pa$$w0rd1

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

10. Giving suitable examples, describe the differences between translation and execution errors. [4]

11. Describe the difference between compilers and interpreters. Give one example of a language which is compiled and one example of a language which is interpreted. [8]

12. This is an algorithm which searches for consecutive data items in three separate one dimensional arrays all of size *n*. You can assume all the arrays have already been populated with data.

```
Algorithm Search

declare i as integer
declare myArray1[n] as integer[]
declare myArray2[n] as integer[]
declare myArray3[n] as integer[]
declare found as string

set i = 0
set found = ""
do

     if myArray1[i] = myArray1[i+1] then
          set found = found + myArray1[i] + " "
     end if

     if myArray2[i] = myArray2[i+1] then
          set found = found + myArray2[i] + " "
     end if

     if myArray3[i] = myArray3[i+1] then
          set found = found + myArray3[i] + " "
     end if

     set i = i + 1

while (i < n)
output "Consecutive data items found: " , found
```

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

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

13. Discuss contemporary approaches to human-computer interaction.

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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