GCE A LEVEL – NEW

1500U30-1

S18-1500U30-1

COMPUTER SCIENCE – A2 unit 3
Programming and System Development

MONDAY, 11 JUNE 2018 – MORNING

2 hours

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

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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 binary tree structure is designed to contain strings and uses the following rules:

- The left pointer indicates the condition "earlier or at the same position in the alphabet"
- The right pointer indicates the condition "later in the alphabet"

(a) Construct a binary tree using these rules and the data entered in the following order: *Goat, Duck, Fox, Bear, Ant, Cat, Leopard, Owl, Mayfly, Insect, Jaguar, Emu.*

You may use the initial letters if you wish. [2]

(b) Carry out a pre-order traversal of the tree and give **one** use of pre-order traversals. [2]

(c) Carry out an in-order traversal of the tree and give **one** use of in-order traversals. [2]

(d) Carry out a post-order traversal of the tree and give **one** use of post-order traversals. [2]

2. The evaluation of a computer based solution should consider system functionality and system performance.

(a) Identify a criterion for the evaluation of the functionality of a system and a criterion for the evaluation of the performance of a system. [2]

(b) Developments in human-computer interaction include natural, immersive and experiential interfaces.

Describe, giving examples, the main characteristics of natural and immersive human computer interfaces. [6]

3. Use a truth table to prove De Morgan's Law $\overline{A + B} = \overline{A} \cdot \overline{B}$. [3]

4. *(a)* Simplify the following using De Morgan's Law's and Boolean identities. Identify which law or identity you are using: [3]

$$\overline{A.B} + A$$

(b) Simplify the following expression using Boolean identities and rules: [5]

$$A.B.(\overline{B} + C) + B.C + B$$

5. A code editor is an essential software engineering tool of an integrated development environment (IDE). It provides features designed to assist with the writing and editing of code.

(a) Describe **two** features of a code editor designed to assist with the writing and editing of code. [4]

(b) An IDE will also include tools for translation and debugging of the code.
State the purpose of code translation. [1]

(c) Errors in the code will stop the program from working as intended. Some errors will prevent code translation, other errors may not be discovered until the program is in use.
Describe, giving examples, an error that will prevent program translation and an error that will not be discovered during translation. [4]

6. An algorithm is shown below.

```
1    decNumber is integer
2    bin is integer
3    answer is string
4
5    while decNumber <> 0
6          if decNumber MOD 2 = 0 then
7                bin = 0
8          else
9                bin = 1
10         end if
11         answer = char(bin) + answer
12         decNumber = decNumber DIV 2
13   end while
14
15   output answer
16
17   end subroutine
```

(a) Dry run the algorithm using the trace table below. [2]

decNumber	decNumber MOD 2	bin	answer
137			

(b) State the purpose of the algorithm. [1]

(c) Explain the selection of data types for “bin” and “answer” in the algorithm. [3]

7. An Institute for ICT technicians in schools and colleges operates a code of conduct.

(a) Describe the purpose of the code of conduct. [2]

(b) Identify **two** standards that should be included in the code for professional competence. [2]

(c) Identify **two** standards that should be included in the code for professional integrity. [2]

8. An online retailer offers a large range of stock items. They use a hash table to store details of the stock items in their computer based stock control system. Each stock item has a key value.

(a) Explain the operation of a hash table and why the time taken to perform search and insertion operations is not affected by the number of stock items stored. [3]

(b) The retailer needs to store customers' delivery details, including their postal address. In this system a postal address is made up of the street, town and postcode.

Street can be a house number or name followed by the name of the street.
All towns begin with an uppercase letter followed by lowercase letters.
All letters in a postcode will be uppercase.
Postcodes can include two or three digits.

Produce an appropriate Backus-Naur Form (BNF) definition for this postal address. [8]

9. The two sections of code below carry out the same task. One section of code uses iteration and the other recursion.

```
Declare subFactorial
fact = 1
input n
for i = 1 to n
     fact = fact * i
next i
print ”factorial of”, n ”is”, fact
end sub
```

```
function factorial(n) is integer
if n <= 1 then
     return 1
else
     return factorial = n * factorial(n-1)
end if
end function
```

(a) Describe iteration. [2]

(b) Describe recursion. [2]

(c) Describe **two** advantages of using an iterative function compared with a recursive function to solve a given problem. [4]

10. *(a)* Describe the purpose of data validation. [2]

(b) Write an algorithm to validate a date in dd/mm/yyyy format. [11]

11. *(a)* Describe what is meant by Object-Oriented Programming (OOP). [4]

(b) Explain the relationship between classes and instances. [3]

(c) Explain what is meant by a method. [3]

12. Explain the need for standardisation of computer languages and discuss the advantages arising from the use of algorithms and programming languages that have been standardised.

You should draw on your knowledge, skills and understanding from a number of areas across your Computer Science course when answering this question. [10]

END OF PAPER

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