GCE A LEVEL – NEW

1500U30-1

COMPUTER SCIENCE – A2 unit 3
Programming and System Development

FRIDAY, 16 JUNE 2017 – MORNING

2 hours

ADDITIONAL MATERIALS

A WJEC pink 16-page pink 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. Two human computer interfaces (HCI) are voice input and touch screen.

    (a) Give **two** benefits of using a touch screen interface on a mobile device. [2]

    (b) Describe the difficulties in creating a natural language interface for voice input. [4]

2. Explain the terms object, class and method in object-oriented programming. [3]

3. *(a)* Draw a truth table to show the value of **P** for all possible values of **A**, **B** and **C** for the following Boolean expression:

$$P = \bar{A} . B + C$$ [4]

    (b) Using the data in the 8 bit register below, design a mask and use it to demonstrate how a logical operation can be used to extract the least significant 4 bits. [3]

Bit number	7	6	5	4	3	2	1	0
Register contents	1	1	1	0	0	0	1	1

4. *(a)* Describe the processes carried out during the lexical, syntax and semantic analyses stages of compilation. [6]

    (b) Describe **one** advantage of using a programming language that requires compiling compared with a programming language that requires interpreting. [2]

    (c) Describe **two** advantages of using a programming language that requires interpreting compared with a programming language that requires compiling. [4]

    (d) State the purpose of an assembler. Describe the difference between the source code of an assembler and the source code of a compiler. [4]

5. *(a)* Using the laws of Boolean algebra and De Morgan's theorem simplify the following Boolean expression:

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

(b) Simplify the following Boolean expression:

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

6. Write a bubble sort algorithm, using pseudo-code, to sort an array of integers into ascending order. [9]

7. The name of a constant in a certain computer language must either be a single uppercase letter, or a single uppercase letter followed by one or more uppercase letters or digits.

(a) Produce an appropriate syntax diagram to define a constant in this language. [4]

(b) Produce an appropriate Backus-Naur Form (BNF) definition for a constant in this language. [4]

8. Below is part of an algorithm that initialises a two dimensional array named GRID of size N x N with zeros.

```
for i = 0 to N - 1
        for j =  0 to N - 1
            GRID(i,j) = 0
        next j
    next i
```

Evaluate the efficiency of the algorithm and, using Big O notation, determine the growth rate for the time performance. [4]

9. *(a)* Define the term algorithm. Other than pseudo-code, state **one** method of expressing an algorithm. [2]

(b) Describe the main characteristics of a recursive algorithm. [2]

(c) Describe **two** disadvantages of using a recursive algorithm. [2]

10. A software company carries out a design review as part of its quality control procedures.

Identify **three** tasks that would be carried out during a design review. [3]

11. A linked list can be ordered or unordered.

(a) Explain the difference between searching for an item in an ordered list compared with searching an unordered list. [2]

(b) The table below includes an unordered list of names.

Index	Data	Next Pointer (1)	Next Pointer (2)	Next Pointer (3)
0	Smith			
1	Jones			
2	Ahmed			
3	Lewis			
4	Thomas			
5	Brown			
6				
7				
8				
9				

(i) Copy the table and complete the **Next Pointer (1)** column to link the list in ascending alphabetical order. [3]

(ii) Add Murphy and Collins to the linked list and complete the **Next Pointer (2)** column. [4]

(iii) Complete the **Next Pointer (3)** column to delete Smith. [2]

(c) Draw a representation of a binary tree using the data items from question **11***(b)* as key values. [3]

12. A debugging tool of an Integrated Development Environment (IDE) enables stepping, break points and variable watches.

Describe the use of stepping, break points and variable watches in the debugging of programs. [6]

13. Compare the Waterfall and Agile approaches to systems analysis and discuss suitable programming paradigms for each approach. [10]

END OF PAPER