



GCE A level

344/01

**COMPUTING CP4
SOFTWARE AND SYSTEM DEVELOPMENT**

P.M. THURSDAY, 5 June 2008

2 hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a 12 page answer book.

INSTRUCTIONS TO CANDIDATES

Answer **all** questions.

The intended marks for questions or parts of questions are given in brackets []. You are advised to divide your time accordingly. The total number of marks available is 70.

You are reminded of the necessity for good written communication and orderly presentation in your answers.

1. Pupil information in a school is held on a computer system.
- (i) Give an example involving pupil information where a *record* would be the most appropriate data structure. Describe why an *array* would not be suitable in this case. [2]
 - (ii) Draw a diagram to show a situation involving pupil information where a *three-dimensional array* would be the most appropriate data structure. [2]
2. A well designed human computer interface (HCI) is very important to the users of a computer system.
- (i) For **each** of the following three types of HCI, describe a **different** situation which could sensibly use this type of HCI and give **one** reason why this would be beneficial in **each** case.
 - (I) handwriting input; [2]
 - (II) speech recognition input; [2]
 - (III) speech synthesis output. [2]
 - (ii) Describe **three** problems associated with speech recognition input. [3]
3. (a) Write down truth tables for:
- (i) the **AND** operation [2]
 - (ii) the **OR** operation [2]
- (b) If **A = 10110001**
B = 11001011
- Carry out the following operations:
- (i) **(A AND B)** [2]
 - (ii) **(A AND B) OR A** [2]
4. A *queue* is a type of data structure.
- (i) Explain, using a diagram, the term *queue*. [2]
 - (ii) Explain what should happen when an attempt is made to add an item to a full queue. [1]
 - (iii) Describe a situation where a queue would be used in a computer system, and explain why the queue is the most appropriate data structure in this case. [2]

5. (a) A standard code for storing characters in a computer system stores the following characters in ascending binary order:

“0”	00110000
“1”	00110001
“2”	00110010

Write down the codes for:

(i) “3” [1]

(ii) “9” [1]

- (b) In a certain computer *sign/magnitude representation* is used to store positive and negative integers using 8 bits.

(i) Explain what is meant by the term *sign/magnitude representation*. [1]

(ii) Demonstrate the use of the sign/magnitude representation using 8 bits, for the integers **5** and **-5** [2]

- (c) Explain the term *overflow* when used in connection with storing numbers in a computer. [1]

- (d) Numbers are often stored in computers in floating point form.

(i) State **one** benefit of storing numbers in floating point form. [1]

(ii) State **one** problem associated with storing numbers in floating point form. [1]

6. (a) State **two** methods of describing algorithms. [2]

- (b) *Quicksort* is a recursive *algorithm*.

(i) Explain the term *recursive algorithm*. [2]

(ii) **Briefly outline** how *Quicksort* operates. [2]

7. (a) Give an example of an application which might use a *special purpose language*. [1]

- (b) Describe **two** features normally available in a *fourth generation language* (4GL). [2]

(c) (i) Describe the difference between a *procedural programming language* and a *non-procedural programming language*. [2]

(ii) Give an example of a suitable use for **each** type of programming language: *procedural and non-procedural*. [2]

- (d) Describe **briefly** what is meant by an *object oriented* approach to programming. [1]

8. The email addresses of students at Clynnog College are made up of the surname plus three digits, followed by the @ sign, followed by **clynnog.ac.uk**

All letters used are in lower case. Assume all surnames consist of letters only, and can be of any length.

For instance, the email address for David Jones is **jones034@clynnog.ac.uk**

- (i) Produce a Backus Naur Form (BNF) definition for a Clynnog College student email address. [4]
- (ii) Produce a syntax diagram for a Clynnog College student email address. [3]

9. The following **incomplete** algorithm is intended to perform a linear search for an item **SearchValue** in an array **Numbers[1..n]** and output the position of the item if it is found.

The asterisks below indicate four lines which are incomplete.

```

1      input SearchValue
2      *   set FoundPosition :=
3      set CurrentPosition := 0
4      while ((FoundPosition = 0) and (CurrentPosition < n ))
5      *           CurrentPosition :=
6      *           if
7      *           then FoundPosition := CurrentPosition
8      *           endif
9      endwhile
10     *   output

```

Copy and complete the four lines indicated by asterisks. [4]

10. **In the following question, additional credit (up to 3 marks) will be gained if your answer demonstrates skill in written communication.**

A *compiler* is used when a computer program is translated into a form ready for execution by a computer. Describe **in detail** the main stages of compilation.

Once the program has been successfully compiled, a *debugging program* may be used with it. Describe **in detail** the various elements which may be available in a debugging program. [8+3]