Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Education
January 2002
Advanced Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

COMPUTING CPT4
Unit 4 Processing and Programming Techniques

Thursday 24 January 2002 Morning Session

No additional materials are required.
You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information
- The maximum mark for this paper is 65.
- Mark allocations are shown in brackets.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
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7			
8			
9			
10			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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Answer **all** questions in the spaces provided.

1 (a) In an object-oriented, computerised encyclopaedia, there is a class called *Creatures*. Two sub-classes of Creatures are *Spiders* and *Beetles*. Draw an inheritance diagram for this.

(2 marks)

(b) For the sub-class Spiders suggest:

(i) **one** property;

.....

(ii) **one** method.

.....

(2 marks)

4

2 (a) In the context of a computer processor, define the term *Clock Speed*.

.....

.....

(1 mark)

(b) Explain how the clock speed affects the speed at which instructions can be executed.

.....

.....

(1 mark)

2

3 Registers are involved in the fetch part of the fetch-execute cycle.
Name **three** of these registers, describe what each will store, and give **one** further detail about its role.

1 Name the register .....

What does it store? .....

Further detail .....

.....

2 Name the register .....

What does it store? .....

Further detail .....

.....

3 Name the register .....

What does it store? .....

Further detail .....

.....

(9 marks)

9

4 Job Control Language is used to control how jobs are run in a batch processing system.

(a) List **two** pieces of information which might be specified in the Job Control Language script for a particular job.

1 .....

2 .....

(2 marks)

(b) Some Job Control Languages allow statements which specify to the Operating System the amount of Input and Output expected relative to the amount of processor time required. How would a Batch multi-programming operating system use this information?

.....

.....

.....

.....

.....

(3 marks)

5

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5 (a) Define a client-server system.

.....

.....

(2 marks)

(b) Give **three** benefits of a client-server system.

1 .....

.....

2 .....

.....

3 .....

.....

(3 marks)

5

6 (a) Define an interrupt.

.....

.....

(1 mark)

(b) Describe how an interrupt from an I/O device is handled.

.....

.....

.....

.....

.....

(3 marks)

4

7 A simple logic processing language is used to represent, as a set of facts and rules, the valid constructions of numbers for a particular task. The set of facts and rules are shown below in clauses labelled i to vi.

i. digit (1|2|3|4|5|6|7|8|9|0)

ii. sign (+|–)

iii. integer IF digit

iv. integer IF digit AND integer

v. number IF integer

vi. number IF sign AND integer

Clause i has the meaning "1, 2, 3, ...0 are all digits"

Clause iv has the meaning "something is an integer if it is a digit followed by an integer"

(a) State whether or not the following numbers are valid and list the clauses used to justify your answer.

(i) 79

.....

.....

(3 marks)

(ii) 148.5

.....

.....

(2 marks)

(iii) –2003598

.....

.....

(3 marks)

(b) One of these numbers is invalid according to the above facts and rules. Write the clause(s) that would make this number valid.

.....

.....

.....

(2 marks)

8 A two byte register holds numbers in floating point form with a 10 bit mantissa and a 6 bit exponent.

(a) Explain the terms:

(i) mantissa; .....

.....

(1 mark)

(ii) exponent. .....

.....

(1 mark)

(b) Each of these holds data in two's complement form. At one moment, this register holds the following bits.

0110101100000011

(i) Label the mantissa in this data.

(1 mark)

(ii) How can you tell if the number is positive or negative?

.....

.....

(2 marks)

(c) Explain, or show, how you would subtract 3 from 5 using two's complement.

.....

.....

.....

.....

.....

(2 marks)

(d) Give **one** advantage of floating point notation over fixed point notation for storing real numbers.

.....

.....

(1 mark)

8

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9 Storage locations 99 and 145 contain the values 145 and 256 respectively.

(a) What value would the accumulator hold after **each** of the following instructions have been executed? (The instructions are to be executed one after the other.)

(i) LDA #99 ;load immediate 99 .....

(ii) ADD 99 ;add direct 99 .....

(iii) ADD (99) ;add indirect 99 .....

(3 marks)

(b) If Register X holds the value 10, in which storage location would the final answer be stored after the following instruction has been executed.

STA 99(X) ;store relative 99 .....

(1 mark)

4

TURN OVER FOR THE NEXT QUESTION

10 The list Ports contains the following names:

[Southampton, Barcelona, Athens, Alexandria, Tunis, Lisbon]

The table below shows some functions which take a list as their single argument and return a result which is either an element of a list or a boolean value.

Head(list) – If the list is non-empty, it returns the element at the head of the list (e.g. Head (Ports) → Southampton) otherwise it reports an error
Tail(list) – If the list is non-empty it returns a new list containing all but the first element of the original list, otherwise it reports an error
Empty(list) – If the list is the empty list it returns True otherwise it returns False. The empty list is donated by [ ]

(a) What result is returned when the following function calls are made?

(i) Tail(Ports) .....

.....

(1 mark)

(ii) Head(Tail(Tail(Ports))) .....

.....

(2 marks)

(iii) Empty(Tail(Tail(Tail(Tail(Tail(Tail(Ports)))))) .....

.....

(2 marks)

A *recursively defined* procedure P, which takes a list as its single parameter, is defined below.

```
Define Procedure P(list)
    If Not Empty(list)
        Then
            P(Tail(list))
            Print Head(list)
    EndIf
EndDefine
```

(b) What is meant by recursively defined?

.....

.....

(1 mark)

(c) Explain why a stack is needed to execute procedure P recursively.

.....

.....

.....

(2 marks)

(d) For the procedure call P(Ports) give the PRINTed output in the order in which it is produced.

.....

.....

(4 marks)

(e) Complete the table to show the list Ports as a linked list so that the ports can be accessed in alphabetical order.

1	Southampton	
2	Barcelona	
3	Athens	
4	Alexandria	
5	Tunis	
6	Lisbon	

Head Pointer

(2 marks)

14

END OF QUESTIONS

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