Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Education
January 2005
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

COMPUTING CPT4
Unit 4 Processing and Programming Techniques

Monday 24 January 2005 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			
5			
6			
7			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 A logic programming language is used to represent, as a set of facts and rules, details of ingredients of foods to help people with special dietary requirements to avoid food they are not allowed to eat.

The sets of facts and rules are shown below in clauses labelled 1 to 12.

1. contains (quiche, eggs).
2. contains (quiche, milk).
3. contains (quiche, bacon).
4. contains (cake, nuts).
5. contains (cake, eggs).
6. contains (burger, beef).
7. contains (cerealbar, nuts).
8. dairyproduct (milk).
9. dairyproduct (cheese).
10. meat (bacon).
11. meat (beef).
12. not_suitable (X, Y) IF contains (X, Y).

Clause	**Meaning**
1	quiche contains eggs
8	milk is a dairy product
10	bacon is meat
12	X is not suitable if it contains Y

(a) Write down the extra clauses needed to express the following facts:

(i) raitha contains yoghurt .....
(1 mark)

(ii) yoghurt is a dairy product .....
(1 mark)

(b) The goal 'dairyproduct (X)?' would return the result: milk, cheese.

Write down the result returned by the goal:

contains (cake, X)? .....
(2 marks)

(c) Write down the goal needed to list all items that are not suitable for a person allergic to eggs:

.....
(2 marks)

(d) Vegetarians do not eat meat.

Complete the rule to list foods, X, that vegetarians will not eat:

not_for_vegetarians (X) IF

.....

(3 marks)

9

2 (a) What is a distributed computer system?

.....

.....

.....

(1 mark)

(b) Give **one** example of a distributed system.

.....

.....

(1 mark)

(c) Give **two** advantages of a distributed system.

1 .....

.....

2 .....

.....

(2 marks)

4

TURN OVER FOR THE NEXT QUESTION

3 (a) A scheduler program in a single processor *multi-programming* operating system maintains a list, in table-form, of runnable *processes* waiting to resume execution.

(i) Explain what is meant by multi-programming.

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.....

.....

(2 marks)

(ii) What is a process?

.....

.....

(1 mark)

(b) Processes are rated in priority according to their expected running times. Processes with the shortest running times are given top priority. A process joining the list will be placed immediately after all other processes of equal or higher priority. The name of the process indicates the order in which it joined the list. Process6 joined the list before Process7.

The table below contains for each process its name, the memory address of its process control block, its expected running time and a pointer to the position in the table of the next process to be executed.

Processes are entered in the table wherever there is a free slot.

(i) Complete the pointer column after the following processes have been placed in the table:

HeadPointer = 6

Position	Name	Running Time	Address	Pointer
1	Process6	7	01400	
2				
3	Process7	17	01700	
4	Process2	17	02300	
5	Process9	45	04100	
6	Process5	2	01200	
7				
8	Process19	5	01900	

(3 marks)

(ii) The scheduler program is written in a high level language. Name and describe a suitable data structure for this table.

.....

.....

(2 marks)

(iii) The Computer System Manager may wish to view the current order in which the runnable processes are predicted to run. Write an algorithm that will print the process names in runnable order.

.....

.....

.....

.....

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(4 marks)

(iv) Name another list of processes that must be maintained by the operating system. Explain why the processes are in this list.

.....

.....

.....

.....

(2 marks)

14

4 (a) What is an interrupt?

.....

.....

.....

(2 marks)

(b) Describe the vectored interrupt mechanism.

.....

.....

.....

.....

.....

(3 marks)

5

5 (a) State **two** advantages of the object-oriented approach to program design over the structured approach to program design.

1 .....

.....

2 .....

.....

(2 marks)

(b) A golf club keeps details of its members. Each member has a unique membership number, first name, surname and telephone number recorded. Three classes have been identified:

Member
MidWeekMember
FullMember

The classes *MidWeekMember* and *FullMember* are related, by single inheritance, to the class Member.

Draw an inheritance diagram for the given classes.

(2 marks)

(c) Programs that use objects of the class *Member* need to add a new member's details, amend a member's details, and show a member's details. No other form of access is to be allowed. Write a class definition for this class.

Member = Class

.....

.....

.....

.....

.....

.....

.....

.....

End

(4 marks)

8

6 A simple microprocessor has an *instruction set* where each instruction is made up of an operation code of 8 bits followed by an operand of 8 bits. Main memory stores both instructions and data. The microprocessor has two *registers* for general use: an accumulator A and an index register X.

(a) What is meant by an instruction set?

.....

.....

(1 mark)

(b) What is a register?

.....

.....

(1 mark)

(c) The following machine operations have these hexadecimal codes:

Machine operation	Addressing mode	Operation Code (Hex)	Description	Example
LDA	Direct Immediate Indirect Indexed	A0 A1 A2 A3	Load accumulator	LDA 75 LDA #75 LDA (75) LDA 75, X
STA	Direct Indirect Indexed	D0 D2 D3	Store accumulator	STA 75 STA (75) STA 75, X
LDX	Direct Immediate Indirect	A4 A5 A6	Load Index register	LDX 75 LDX #75 LDX (75)
ADC	Direct Immediate Indirect Indexed	C0 C1 C2 C3	Add operand to contents of accumulator, storing result in accumulator	ADC 75 ADC #75 ADC (75) ADC 75,X

Explain what the effect is of **each** of the following instructions.

(i) LDA #75.....

.....

(1 mark)

(ii) STA 75.....

.....

(1 mark)

(iii) LDA 75, X.....

.....

(2 marks)

(iv) STA (75).....

.....

(2 marks)

(d) The following table shows a memory dump of memory locations 00A1 to 00A6.

Address	**Memory Location contents**	**Hexadecimal equivalent**
00A1	0000 0000 1100 0011	00C3
00A2	0000 0000 0000 0000	0000
00A3	1010 0101 0000 0001	A501
00A4	1010 0000 1010 0001	A0A1
00A5	1100 0001 0000 0101	C105
00A6	1101 0011 1010 0001	D3A1

(i) What is the denary value of the content of location 00A1?

.....

.....

(1 mark)

(ii) Why is hexadecimal used as a notation in this context?

.....

.....

(1 mark)

(iii) If the program counter contains 00A3, complete the following trace table:

Program Counter	**Content of Index Register X**	**Content of Accumulator A**
00A3		
00A4		
00A5		
00A6		

(4 marks)

(iv) What effect does the instruction at address 00A6 have?

.....

(1 mark)

7 The binary pattern 1011 1110 0100 could be interpreted in a number of different ways.

(a) State its hexadecimal representation. .....

(1 mark)

(b) State its value in denary if it represents an unsigned fixed point number with four bits after the binary point. Use the space below to show your working.

.....

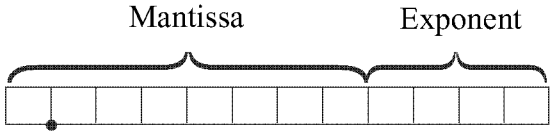
(3 marks)

(c) State its value in denary if it represents a two's complement integer.

.....

(2 marks)

(d) The system stores floating point numbers in *normalised form* using 2's complement, with an 8-bit mantissa and a 4-bit exponent as follows.



(i) State the value of 1011 1110 0100 in denary if it represents a two's complement floating point number. Use the space below to show your working.

.....

(3 marks)

(ii) This floating point number is said to be normalised.
How does the bit pattern indicate that this number is normalised?

.....

.....

(1 mark)

END OF QUESTIONS

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