Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

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General Certificate of Education
June 2006
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

COMPUTING **CPT4**
Unit 4 Processing and Programming Techniques

Tuesday 20 June 2006 9.00 am to 10.30 am

You will need no other materials.
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.
- Answer the questions in the spaces provided.
- Show all your working.
- 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.
- The marks for questions are shown in brackets.
- The use of brand names in your answers will **not** gain credit.
- You are reminded of the need for good English and clear presentation in your answers. Quality of Written Communication will be assessed in all answers.

For Examiner's Use			
Number	Mark	Number	Mark
1		5	
2		6	
3		7	
4		8	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 (a) Convert the denary values 27 and –19 into 8-bit binary integers using two's complement format.

27 | | | | | | | | |

–19 | | | | | | | | |

(3 marks)

(b) Add together your two 8-bit binary values.

27 | | | | | | | | |

–19 | | | | | | | | |

Result | | | | | | | | |

(2 marks)

(c) The result has an additional bit.

(i) Give the name of this bit .....

(1 mark)

(ii) How can it be used? .....

.....

(1 mark)

(d) State your binary values for 27 and –19 in Hexadecimal.

27 .....

–19 .....

(2 marks)

9

2 (a) Using an example, outline the principles of Client-Server operation.

.....

.....

.....

.....

(3 marks)

(b) A single processor may need to perform many tasks at the same time. This can be done by *multiprogramming* and/or *multi-threading*. Explain what is meant by

(i) Multiprogramming .....

.....

.....

.....

(2 marks)

(ii) Multi-threading .....

.....

.....

.....

(2 marks)

(c) Operating systems are often described as *event driven*.

(i) Explain what is meant by the term event driven.

.....

.....

.....

(2 marks)

(ii) Give an example of an event.

.....

.....

(1 mark)

10

Turn over ▶

3 The following represents part of the internal memory of an 8-bit computer system.

Address	Contents
01000000	00000000
01000001	01000101
01000010	11110000
01000011	01010100
01000100	00000000
01000101	00001111
01000110	11111111
01000111	00000011
01001000	00110000

(a) The instruction op-code LD causes data to be loaded into the accumulator. What will the accumulator contain after the operation LD 01000001 has been executed if the instruction uses

(i) immediate addressing

.....

(1 mark)

(ii) direct addressing

.....

(1 mark)

(iii) indirect addressing.

.....

(1 mark)

(b) (i) Explain what is meant by indexed addressing.

.....

.....

.....

.....

(4 marks)

(ii) Give a situation where indexed addressing might be used.

.....

.....

(1 mark)

8

4 One of the roles of an Operating System is to manage memory.

(a) Explain what is meant by the memory management technique known as virtual memory.

.....

.....

.....

(3 marks)

(b) Explain what is meant by the memory management technique known as paging.

.....

.....

.....

(2 marks)

(c) Explain what is meant by the heap and how it is used by the operating system.

.....

.....

.....

(2 marks)

7

Turn over for the next question

5 A *linear search* and a *binary search* are two different methods of searching an ordered list. A given list contains 271 items.

(a) (i) What is the maximum number of items accessed when searching for a particular item from the given list using a linear search?

.....

(1 mark)

(ii) Explain your answer.

.....

.....

(1 mark)

(b) (i) What is the maximum number of items accessed when searching for a particular item from the given list using a binary search?

.....

(1 mark)

(ii) Explain your answer.

.....

.....

(1 mark)

(c) An integer array A contains the following items.

	A
[1]	23
[2]	45
[3]	16
[4]	12
[5]	31

(i) Dry run the following algorithm by completing the trace table, **Table 1**.

```
For Count1 ← 1 To 4
  For Count2 ← 1 To 4
    If A[Count2] > A[Count2 + 1] Then
      Temp ← A[Count2]
      A[Count2] ← A[Count2 + 1]
      A[Count2 + 1] ← Temp
    EndIf
  EndFor
EndFor
```

Table 1

Count1	Count2	Temp	A				
			[1]	[2]	[3]	[4]	[5]
–	–	–	23	45	16	12	31
1	1						

(5 marks)

(ii) What is the purpose of this algorithm?

.....

(1 mark)

(iii) Suggest **one** way the algorithm could be improved.

.....

(1 mark)

11

Turn over ▶

6 Using the table below, write the assembly language equivalent of the following code.

```
X ← 0
For Count ← 1 To 5
  X ← X + Count
EndFor
```

Write a comment to explain each assembly language statement used.

Label	Op-code	Operand(s)	Comment

(8 marks)

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7 A computer system has a clock speed of 1 GHz, a 16-bit data bus and a 24-bit address bus. What would be the precise effect of

(a) increasing the clock speed to 2 GHz?

.....

.....

.....

(1 mark)

(b) increasing the size of the data bus to 32 bits?

.....

.....

.....

(1 mark)

(c) increasing the width of the address bus to 32 bits?

.....

.....

.....

.....

(2 marks)

4

Turn over for the next question

8 A logic program is used to represent, as a set of facts and rules, personal details. The set of facts is shown below in clauses labelled 1 to 13.

```
 1.  male (harry).
 2.  male (kevin).
 3.  male (michael).
 4.  male (john).
 5.  female (linda).
 6.  female (kylie).
 7.  female (sarah).
 8.  female (tanya).
 9.  parent (michael, harry).
10.  parent (linda, harry).
11.  parent (michael, kevin).
12.  parent (linda, kevin).
13.  parent (sarah, linda).
```

Clause	Meaning
1	There is a male person called harry.
5	There is a female person called linda.
9	A parent of harry is michael.

(a) There is a boy named richard whose parents are john and kylie. Write the extra clauses required to represent these facts.

.....

.....

.....

(3 marks)

(b) The goal `parent (Name, linda)` would return the result `sarah`.

Write the result returned by the goal `parent (Name, kevin)`.

.....

(2 marks)

(c) Complete a rule that could be used to list the fathers.

`father (Dad, Child)` .....

.....

.....

(3 marks)

8

END OF QUESTIONS

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