

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use
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General Certificate of Education  
June 2007  
Advanced Level Examination



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

**CPT4**

Tuesday 19 June 2007 9.00 am to 10.30 am

<p><b>You will need no other materials.</b> You may use a calculator.</p>
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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 to be 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.

For Examiner's Use			
Question	Mark	Question	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 The decimal number 57 is entered on a keyboard in the form of two ASCII characters ‘5’ and ‘7’. These are stored in the computer’s memory as

0	0	1	1	0	1	0	1
0	0	1	1	0	1	1	1

- (a) Express these binary values in hexadecimal.

.....  
(1 mark)

- (b) Express these binary values in denary.

.....  
(1 mark)

- (c) By completing **Table 1**, show how the decimal value 57 could be stored as a signed integer using two’s complement in 8 bits.

**Table 1**

--	--	--	--	--	--	--	--

(2 marks)

- (d) By completing **Table 2**, show how the decimal value 57.0 could be stored in normalised floating point form as an 8 bit mantissa followed by an 8 bit exponent. Both mantissa and exponent are to be stored as signed values using two’s complement.

**Table 2**

Mantissa								Exponent							
●															

(2 marks)

- (e) Give **two** advantages of normalised floating point format over fixed point format.

1 .....

.....

2 .....

.....

(2 marks)

2 (a) In order to operate a new mouse attached to a computer system a device driver is required.

(i) What is the purpose of a device driver?

.....  
.....  
*(2 marks)*

(ii) Why is it not always provided as part of the operating system?

.....  
.....  
*(2 marks)*

(iii) What type of programming language is normally used to write device drivers?

.....  
*(1 mark)*

(iv) Give **two** reasons for your choice of language type.

1 .....  
.....  
2 .....  
.....  
*(2 marks)*

(b) A mouse driver may well use the interrupt mechanism.

(i) Give a use of a mouse that will generate an interrupt.

.....  
*(1 mark)*

(ii) What does an interrupt service routine do when an interrupt occurs?

.....  
.....  
.....  
*(3 marks)*

3 A processor contains an Arithmetic Logic Unit, a control unit and a number of registers.

(a) What is the function of the Arithmetic Logic Unit?

.....  
.....  
*(1 mark)*

(b) What is the function of the control unit?

.....  
.....  
*(1 mark)*

(c) Registers may be general purpose or special purpose. Name **three** special purpose registers (do not use abbreviations).

1 .....  
2 .....  
3 .....  
*(3 marks)*

5

4 (a) Data is stored on a disk in addressable blocks. In this context what constitutes an address?

.....  
.....  
.....  
*(3 marks)*

(b) What is meant by a file buffer?

.....  
.....  
.....  
*(2 marks)*

5

5 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 15.

- 1. person (sarah)
- 2. person (lydia)
- 3. person (julian)
- 4. person (john)
- 5. vegetable (potato)
- 6. vegetable (carrot)
- 7. meat (lamb)
- 8. meat (beef)
- 9. eats (sarah,potato)
- 10. eats (sarah,carrot)
- 11. eats (lydia,lamb)
- 12. eats (julian,beef)
- 13. eats (julian,potato)
- 14. eats (john,potato)
- 15. eats (john,carrot)

Clause	Meaning
1	There is a person called sarah.
5	There is a vegetable called potato.
7	There is a meat called lamb.
9	sarah eats potato.

(a) There is a person named ronald who eats chicken and lamb. Write the extra clauses required to represent these facts.

.....

.....

.....

.....

(3 marks)

(b) The clause `eats (lydia, Food)` would return the result `lamb`.

Write the result returned by the goal `eats (Name, carrot)`.

.....

(2 marks)

(c) Complete a rule that could be used to list the people who do not eat meat.

`vegetarian (Name) IF`

.....

.....

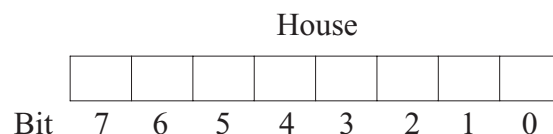
.....

(3 marks)

- 6 A computer system has the following assembly code instructions, some of which you are to use in this question.

Label	OpCode	Operand	Description
label1:	DEFB		Allocate a byte of memory for a variable
label2:	DEFB	#nn	Allocate a byte of memory for a variable and initialise it to the hexadecimal value nn
	AND	#nn	Logical AND the accumulator with hexadecimal value nn
	OR	#nn	Logical OR the accumulator with hexadecimal value nn
	LD	#nn	Load the hexadecimal value nn into the accumulator
	LD	label	Load contents of the labelled memory into the accumulator
	ST	label	Store contents of the accumulator into the labelled memory
	ADD	#nn	Add the hexadecimal value nn to the current contents of the accumulator storing result in the accumulator
	ADD	label	Add the contents of the labelled memory to the accumulator
	SUB	#nn	Subtract the hexadecimal value nn from the accumulator
	SUB	label	Subtract the contents of the labelled memory from the accumulator
	CMP	#nn	Compare the accumulator with hexadecimal value nn
	CMP	label	Compare the accumulator with the contents of the labelled memory
	JP	label	Jump unconditionally to the label
	JE	label	Jump to the label if the result of a compare shows the accumulator to be equal to the operand
	JG	label	Jump to the label if the result of a compare shows the accumulator to be greater than the operand
	JGE	label	Jump to the label if the result of a compare shows the accumulator to be greater than or equal to the operand
	JL	label	Jump to the label if the result of a compare shows the accumulator to be less than the operand
	JLE	label	Jump to the label if the result of a compare shows the accumulator to be less than or equal to the operand

A large greenhouse is to be controlled by a microprocessor. The microprocessor has a device that measures the temperature in the greenhouse and places the value in a memory location labelled Temp. The greenhouse has windows that can be opened and closed. There is an 8 bit memory location labelled House that is used to control the windows.



To open the windows bit 0 must be set to a 1, to close the windows bit 0 must be set to a 0. The remaining bits of House are used for other purposes and must not be changed.



- 7 (a) In object-oriented programming, what is meant by aggregation?

.....  
.....

(1 mark)

- (b) An object-oriented program is required to handle details of items of furniture that are for sale. The furniture sold includes dining suites. A dining suite consists of a table and a number of chairs.

Some fields required for the suites are

TableType  
ChairType  
NumberOfChairs

A method required for the suites is

DisplayDetails

Some fields required for the tables are

TableType  
Size  
Colour

Some fields required for the chairs are

ChairType  
Colour

- (i) Draw a **class diagram** of these classes, Suite, Table and Chair.

(2 marks)



8 A *recursively-defined* procedure **ProcA** that takes two integers as parameters is defined below.

(a) What is meant by a recursively-defined procedure?

.....  
 .....  
 (1 mark)

(b) What is the role of the stack when a recursively-defined procedure is executed?

.....  
 .....  
 (1 mark)

(c) Dry run the procedure call **ProcA(11,1)** using the data in the array, **Items**, by completing the trace table, **Table 3**.

```

Procedure ProcA (Number, Entry)
  If Number <> Items[Entry]
    Then ProcA (Number, Entry+1)
    Else Output (Entry)
  EndIf
EndProc
    
```

Items	
[1]	4
[2]	5
[3]	8
[4]	11
[5]	15
[6]	19
[7]	21
[8]	28
[9]	33

**Table 3**

Number	Entry	Output
11	1	

(4 marks)

(d) What is the purpose of this algorithm?

.....  
(1 mark)

(e) Give a situation where this algorithm will fail.

.....  
.....  
(1 mark)

(f) Suggest a modification to the algorithm that will prevent it from failing.

.....  
.....  
(1 mark)

(g) With an ordered array, Items, of many more entries, what more efficient algorithm could be used to achieve your expressed purpose in part (d)?

.....  
.....  
(1 mark)

<b>10</b>

**END OF QUESTIONS**

**There are no questions printed on this page**