

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced GCE**

**COMPUTING**

**2509**

Systems Software Mechanisms, Machine Architecture,  
Database Theory and Programming Paradigms

Monday **24 JANUARY 2005** Morning 1 hour 30 minutes

Candidate Name	Centre Number	Candidate Number											
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**TIME** 1 hour 30 minutes

**INSTRUCTIONS TO CANDIDATES**

- Write your name in the space above.
- Write your Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- If you run out of space for an answer, continue on the spare pages at the back of the booklet.
- If you use these spare pages, you must write the question number next to your answer. You can also use these spare pages for rough work.

FOR EXAMINER'S USE	
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**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 90 (86 + 4 written communication).
- You will be awarded marks for the quality of written communication where an answer requires a piece of extended writing.
- No marks will be awarded for using brand names of software packages or hardware.

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**This question paper consists of 10 printed pages and 2 lined pages.**

1 An interrupt is used to obtain processor time.

(a) State the meaning of the term *interrupt*.

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.....  
.....[2]

(b) State **two** examples of sources of interrupts and explain why they might have different priorities.

Example 1. ....

Example 2. ....

Reason .....

.....  
.....[3]

(c) Describe how an interrupted job may be resumed.

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.....[3]

2 (a) (i) Describe the purpose of a compiler.

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.....[2]

(ii) Explain the difference between a compiler and an interpreter.

.....  
.....[1]

(b) Describe syntax analysis.

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.....[2]

(c) Describe the purpose of a linker.

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.....[3]

3 (a) Describe Von Neumann architecture.

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(b) Two of the registers used by a processor are the memory address register (MAR) and the program counter (PC). Describe how these registers are used during the fetch-decode-execute cycle.

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(c) (i) Explain how a parallel processor system might handle a complex problem.

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.....[3]

(ii) State **one** advantage and **one** disadvantage of a parallel processor system.

Advantage .....

.....

Disadvantage .....

.....[2]

4 A sequential file contains the following data:

apple, banana, cherry, melon, orange, pear, plum

(a) (i) Explain the stages of a serial search for "damson" in the file.

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.....[3]

(ii) Explain the stages of a binary search for "pear".

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**(b)** Explain an advantage of a binary search compared with a serial search when used for searching a sequential file of 20 000 items of data.

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.....[2]

**(c)** Show the stages of a quick sort to put the following numbers into ascending numerical order:

24    8    37    11    15

[6]

5 A furniture warehouse allocates product codes to its stock. Using Backus-Naur Form (BNF), the definition of a code is

< ALPHA > ::= B | C | D | S | W  
< DIGIT > ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  
< CODE > ::= < DIGIT > < ALPHA > | < DIGIT > < CODE >

(a) State whether each of the following is a valid code or an invalid code. In the case of an invalid code, explain how the rules have been broken.

(i) 123D

.....  
.....  
.....

(ii) B24

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(iii) 3A5

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.....

[6]

(b) Draw a syntax diagram to represent the definition of < CODE > given at the start of this question.

[3]

(c) Using the definitions of < ALPHA > and < DIGIT > given at the start of this question, and < SYMBOL > where  
 < SYMBOL > ::= # | %  
 write a BNF definition for < IDENTITY > where IDENTITY start with either # or %, then one ALPHA and any number (including zero) of DIGITs. For example, #B and %C1234 are valid while #BC5 is not valid.

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 .....[3]

(d) Explain the need for BNF.

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 .....[2]

6 A mail order company stores data about the entities Customer and Order in a relational database. A customer may have more than one order.

(a) Giving examples for Customer and Order, explain the terms

(i) Primary key

.....  
 .....  
 .....[2]

(ii) Foreign key.

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 .....[3]

**(b)** The database also stores an entity Product. The relationship between Product and Order is many-many.

**(i)** Draw an entity-relationship (E-R) diagram for Customer, Order and Product for the system described.

[4]

**(ii)** State why normalisation is necessary.

.....  
.....[1]

**(iii)** Draw another E-R diagram to show the entities after normalisation.

[3]



7 (a) Describe the use of the accumulator in executing a program.

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.....[3]

(b) Describe direct addressing and indirect addressing.

Direct addressing .....

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.....

Indirect addressing .....

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.....[4]

8 Data about plants in a garden centre is to be stored alphabetically using a linked list.

(a) Explain the difference between static and dynamic data structures.

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.....[2]

(b) (i) Complete the following diagram to show the linked list.



[3]

(ii) Write an algorithm for the deletion of a data item from a linked list.

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