

**ADVANCED GCE UNIT
COMPUTING**

2509

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

WEDNESDAY 24 JANUARY 2007

Morning

Time: 1 hour 30 minutes

No additional materials are required.



Candidate
Name

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- 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.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- **WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.**

INFORMATION FOR CANDIDATES

- The number of marks for each question 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 for the quality of 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.

For Examiner's Use		
Question no.	Max. mark	Mark
1	11	
2	12	
3	7	
4	9	
5	14	
6	14	
7	11	
8	8	
WC	4	
Total	90	

This document consists of **15** printed pages and **1** lined page.

Answer **all** questions.

1 (a) Explain the purpose of scheduling in a multi-user operating system.

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

(b) In the context of printing,

(i) describe spooling.

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

(ii) explain why spooling is used.

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

(c) In a network operating system,

(i) state the meaning of the term privacy of data.

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

(ii) describe how privacy of a user's data can be maintained.

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

2 (a) Explain the purpose of linkers and loaders when a program is run.

.....
.....
.....
.....
.....
.....
.....
..... [4]

(b) One stage of the compilation process is code generation.

(i) List the **three** stages of compilation, including code generation, in the correct order.

1
2
3 [2]

(ii) The code generation stage includes optimisation.

Explain the term optimisation.

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

(c) Explain why the code produced during compilation may not be executable code.

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

(d) State **two** reasons why the distributable version of a program is usually in executable code.

1
.....
2
..... [2]

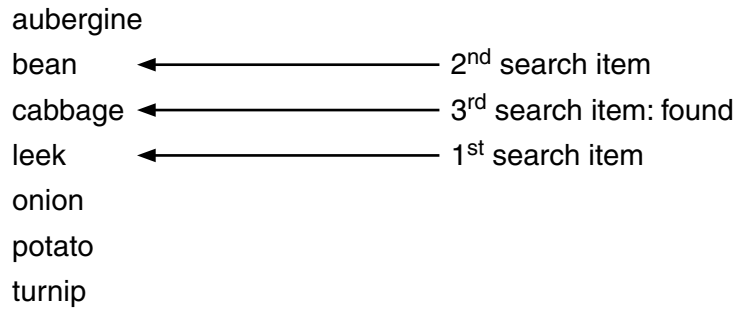
3 (a) Describe pipelining.

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

(b) Describe how the memory address register (MAR) and the memory data register (MDR) are used when an instruction is processed.

.....
.....
.....
.....
.....
..... [4]

4 (a) A list of words is to be searched for the word 'cabbage'. The diagram shows the method used.



(i) Give the correct name for this method.

..... [1]

(ii) Explain **one** benefit of using this method for searching data.

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

(iii) The same method is to be used for searching for the word 'three' in the list

one, two, three, four, five, six, seven

State what needs to be done before starting the search.

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

(b) (i) State the main feature of a stack data structure.

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

- (ii) On the diagram, show the result of adding the words
apple, banana, cherry
in this order to an empty stack.

Label your diagram to make your answer clear.



[2]

- (iii) State the meaning of the terms overflow and underflow when they are errors associated with a stack.

Overflow

.....
.....

Underflow

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

5 (a) The table shows a number of statements about types of programming language.

For each row, tick **one** box to show the type of programming language for which the statement is correct.

	Declarative	Object-oriented	Procedural
Program statements may be given in any order			
Encapsulation is used			
Backtracking is used			
Facts and rules state what to do but not how to do it			
Instantiation is used			
Data is only accessible through methods			

[6]

(b) A company has a number of employees. All employees are either part-time or full-time.

In an object-oriented program, three classes are Employee, PartTimeEmployee and FullTimeEmployee.

Using this example, explain the meaning of the following terms.

(i) Class

.....

.....

.....

..... [2]

(ii) Inheritance

.....

.....

.....

..... [2]

(iii) Object

.....

.....

.....

..... [2]

(iv) Draw an inheritance diagram to show the three classes.

[2]

[Turn over

6 In a college, data is stored about students, courses and tutors.

For example, Joe Smith is studying French A level taught by Mrs Jones and also studying German AS level taught by Mr Harris. Anu Patel is studying French A level taught by Mrs Jones. Other data includes both students' and tutors' addresses and the room numbers where courses are taught.

(a) State **three** advantages of storing the data in a relational database compared with a flat file.

- 1
- 2
- 3 [3]

(b) State the meaning of the term entity, giving an example from the database described.

-
-
- [2]

(c) State the meaning of the term attribute, giving an example from the database described.

-
-
- [2]

(d) Design a form that could be used to input details of a new student.

[4]

(e) Explain the term data manipulation language (DML) and give an example of its use in this database.

.....

.....

.....

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.....

.....

..... [3]

[Turn over

7 (a) Explain the term top-down design and its use in program development.

.....

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.....

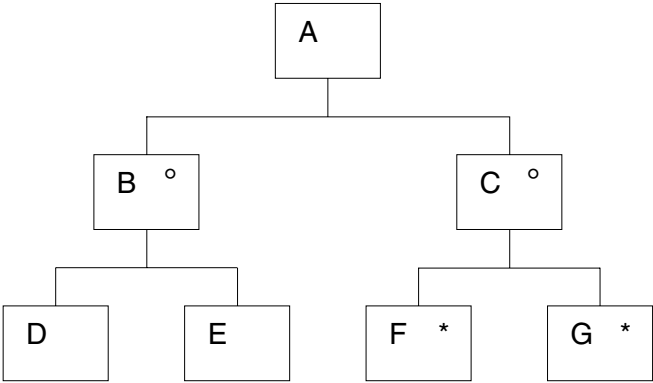
.....

.....

.....

..... [4]

(b) A section of a Jackson Structured Programming (JSP) diagram is shown.



From the diagram, give **one** example of each of the following.

- (i) A sequence
..... [1]
- (ii) A selection
..... [1]
- (iii) An iteration
..... [1]

- (c) The method used to produce a certain piece of coursework is either to use a spreadsheet to do a number of calculations or to use a database to prepare several reports. The results are then printed and a front cover produced.

Draw a JSP diagram, using the notation in part (b), to show how the coursework is produced.

[4]

8 In any calculations, you must show how you obtain your answers.

A binary number may be written in a floating point representation as shown.
 The binary point is between the first two bits of the mantissa.
 The exponent is a whole number.
 Both mantissa and exponent are in two's complement binary form.

0 1 0 1 0	0 1 0
mantissa	exponent

(a) (i) Write down the denary value represented by the exponent in this example.

.....
 [1]

(ii) Calculate the denary value of the binary number in this example.

.....

 [2]

(b) Write, in binary, the largest number that can be represented in this format.

.....

 [2]

(c) Another binary number is written in the same format as

0 0 1 1 1	0 1 1
mantissa	exponent

Write this number in its normalised form.

.....

 [2]

(d) State why binary numbers should be normalised.

.....
 [1]

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