OCR
RECOGNISING ACHIEVEMENT

Tuesday 12 June 2012 – Afternoon

A2 GCE COMPUTING

F453/01 Advanced Computing Theory

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
None

Duration: 2 hours

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

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 **120**, of which marks are allocated to the assessment of the quality of written communication where an answer requires a piece of extended writing.
- This document consists of **24** pages. Any blank pages are indicated.

1 **(a)** Operating systems use scheduling.

(i) Explain the purpose of scheduling.

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(ii) Some multi-user operating systems use round-robin scheduling.

Describe round-robin scheduling.

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(iii) Describe **one** other scheduling method that may be used.

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(b) (i) Explain the term priority in relation to jobs awaiting processing.

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(ii) A job with low priority may have its priority changed by the operating system.

Explain why this might be necessary.

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

2 When a program has been written in a high level language, either an interpreter or a compiler may be used.

(a) Compare the use of interpreters and compilers. You should describe the features of each, and the differences between them.

The quality of written communication will be assessed in your answer to this question.

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[8]

TURN OVER FOR NEXT QUESTION

(b) Some compilers produce intermediate code.

Describe the purpose of intermediate code.

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3 **(a)** Some computer systems use a parallel processor, while others use an array processor.

(i) Describe a parallel processor system.

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(ii) Describe an array processor system.

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(b) Give **two** features of a Reduced Instruction Set Computer (RISC) architecture.

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2. .....

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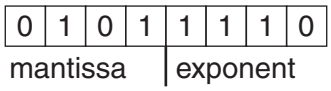
4 In each part of this question, **all working must be shown**.

A real binary number may be represented in normalised floating point binary notation using 4 bits for the mantissa and 4 bits for the exponent, both in two's complement binary.

(a) Convert the following number to denary:



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(b) Convert the denary number 24 into the binary representation described.

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

(c) Explain why it is **not** possible to represent each of the following denary numbers accurately in the binary representation described.

(i) 130

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

(ii) $1\frac{1}{16}$

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5 **(a)** The size of some data structures is fixed when the structure is created.

State the term used to describe such data structures.

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Give **one** example of a type of data structure whose size is always fixed.

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Give **one** advantage of using a fixed size data structure.

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

A queue data structure has two pointers called **front** and **next** which are defined as:
front points to the first item in the queue
next points to the next available space

The queue is defined as a first in, first out (FIFO) data structure.

(b) **(i)** State the condition of the pointers when the queue is empty.

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

(ii) Write an algorithm to remove one data item from a queue.

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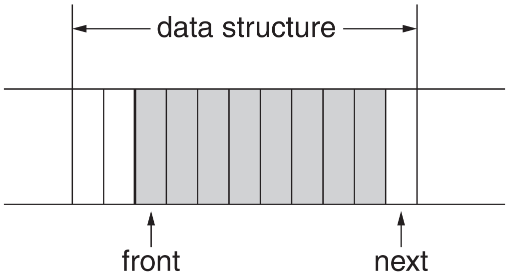
(c) The queue may be represented by a fixed size data structure.



Explain, with the aid of a diagram, what happens when attempting to add 3 data items to the queue.

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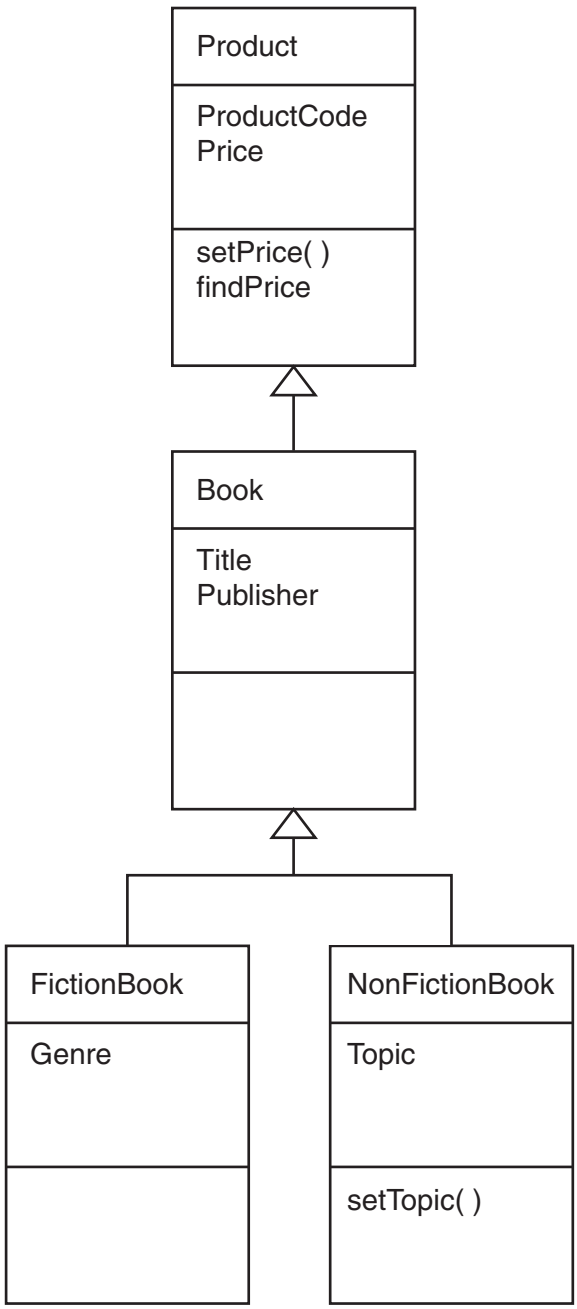
6 A bookshop uses an object-oriented programming language for its stock control system. Part of the Unified Modelling Language (UML) class diagram is shown.



(i) Using examples from the diagram, explain the term derived class.

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

(ii) If thisBook has been defined as an instance of a NonFictionBook, explain why each of the following programming statements is valid:

thisBook.setTopic("Computing")

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

thisBook.findPrice

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

(iii) The owner of the bookshop decides to sell gift-wrapping materials. Add the class GiftWrap to the class diagram on page 12, with attributes Type and Colour. **[3]**

7 **(a)** A program uses procedure calling and parameter passing.

(i) Explain the term procedure.

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

(ii) Explain how parameters are used.

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(b) You are given the following information.

- A programming language allows statements to be written.
- Each statement may be a comment or a piece of code.
- Comments must have zero or more characters, surrounded by curly brackets.
- A piece of code has one or more characters.

For example,
- { }
- {A comment}

are both comments, and
- This is code

is a piece of code.
(The symbols { and } are not considered to be characters.)

<char> represents any character and
<statement>, <comment> and <code> represent statements, comments and pieces of code respectively.

Write BNF (Backus-Naur Form) definitions in their simplest form for

<code>

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

<comment>

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

<statement>

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

8 **(i)** Explain the term low-level language.

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(ii) Using the instruction ADD 45, explain the terms opcode and operand.

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(iii) Using an example, describe immediate addressing.

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(iv) Using an example, describe direct addressing.

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9 **(a)** Data may be stored in a relational database or in flat files.

(i) Give **three** advantages of a relational database compared with flat files.

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(ii) State **one** application for which a flat file may be more appropriate than a relational database and give a reason for your answer.

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

(b) A relational database is used to store information for a large company.
Part of the code used with the database is

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CREATE VIEW SOME_DATA AS
    SELECT StaffId, Surname, Department
    FROM STAFF
    WHERE StartDate < 2010
```

(i) Give the correct name for this programming language. (Do not use abbreviations.)

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

(ii) State **two** reasons why views of data are used.

1. .....

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2. .....

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

(iii) Explain the result of the code given above.

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TURN OVER FOR NEXT QUESTION

10 Sarah is a freelance photographer. She sells her photos to magazine companies or to private customers. Some days she goes on a photoshoot to take a number of photos; she may go on more than one photoshoot on the same day.

In order to organise her work, she plans to use a relational database. She has identified that she needs to store the following:

PHOTO:

PhotoId	Photo reference number
Type	Colour or black & white photo
ShootId	Photoshoot reference number

PHOTOSHOOT:

ShootId	Photoshoot reference number
Location	The place where photos were taken e.g. Oxford
Date	Date of photoshoot
StartTime	Time the photoshoot started e.g. 08:30

SALE:

SaleId	Sale reference number
PhotoId	Photo reference number
CustomerId	Customer reference number
SaleDate	Date the photo was sold

(a) From the information given, state **one** foreign key and explain how it is used in this database.

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

(b) Draw an entity-relationship (E-R) diagram to show PHOTO, PHOTOSHOOT and SALE, using only the information given.

[4]

(c) The database design is incomplete.

Identify **one** further entity that is needed and explain why it should be added to the database. Give the primary key and **one** other attribute for this entity.

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(d) Explain what is meant by a secondary key.

Name and describe the use of a secondary key in PHOTOSHOOT.

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END OF QUESTION PAPER

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