

<b>Candidate forename</b>						<b>Candidate surname</b>					
<b>Centre number</b>						<b>Candidate number</b>					

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**A2 GCE**  
**F453/01**  
**COMPUTING**

**Advanced Computing Theory**

**TUESDAY 12 JUNE 2012: Afternoon**  
**DURATION: 2 hours**  
**plus your additional time allowance**

**MODIFIED ENLARGED**

**Candidates answer on the Question Paper.**

**OCR SUPPLIED MATERIALS:**

**None**

**OTHER MATERIALS REQUIRED:**

**None**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- **Write your name, centre number and candidate number in the boxes on the first page. 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.**

## **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.**

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

**(i) Explain the purpose of scheduling.**

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**[4]**

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

**Describe round-robin scheduling.**

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**[4]**

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

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**[2]**

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

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[2]

**(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.**

[illegible]

[illegible]

[8]



**(b) Some compilers produce intermediate code.**

**Describe the purpose of intermediate code.**

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**[3]**

**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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**[4]**

**(ii) Describe an array processor system.**

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**[3]**

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

1. \_\_\_\_\_

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2. \_\_\_\_\_

\_\_\_\_\_ [2]

- 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:

0	1	0	1	1	1	1	0
mantissa				exponent			

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[3]

**(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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**[3]**

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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.**

\_\_\_\_\_

\_\_\_\_\_ [1]

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

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\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

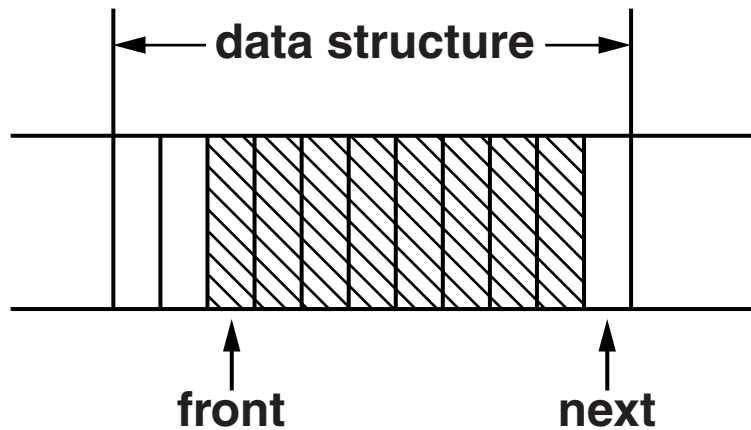
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\_\_\_\_\_ [4]

(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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**[5]**

**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 on the next page.**

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

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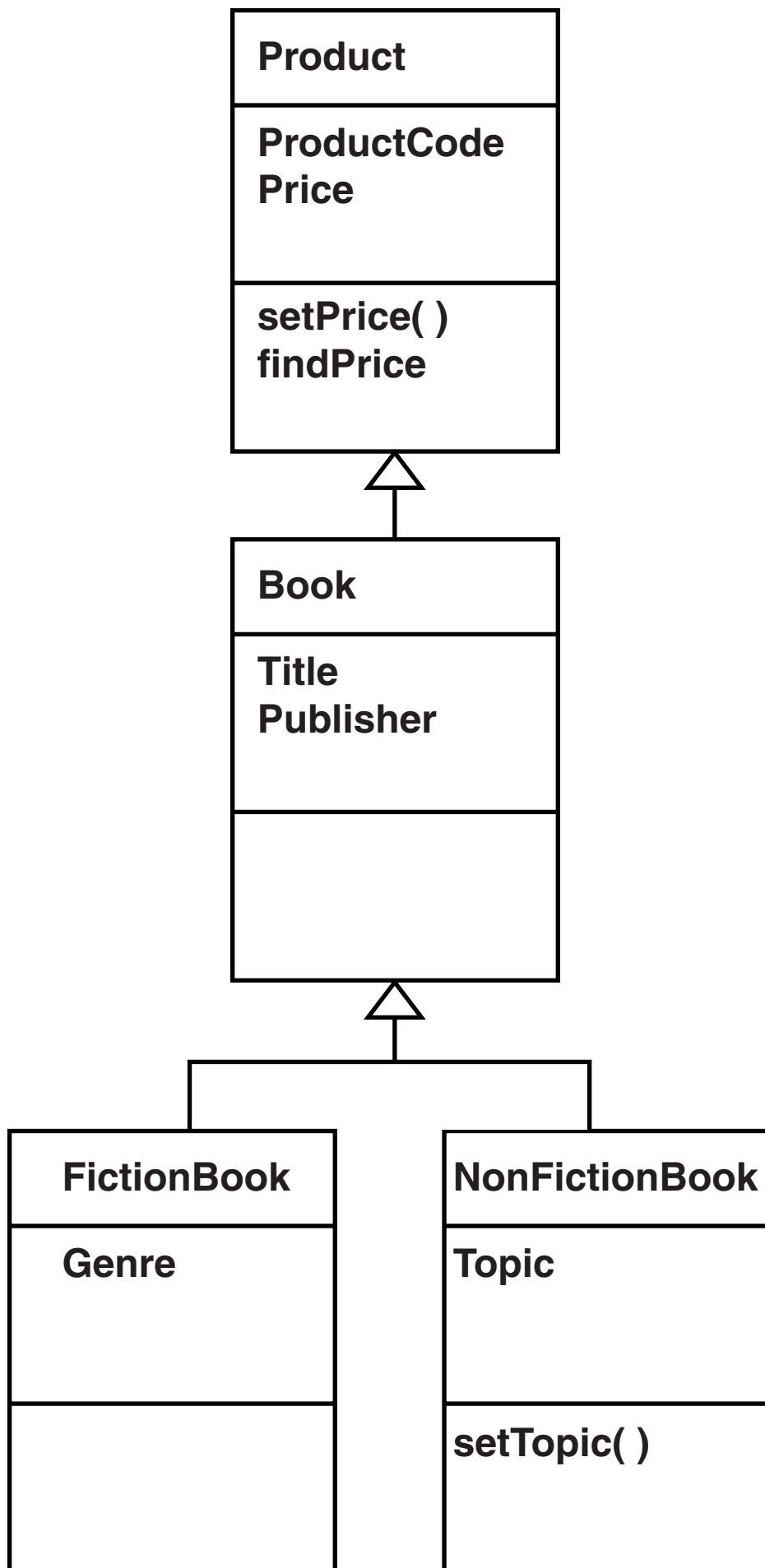
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**[3]**



- (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")`

\_\_\_\_\_ [1]  
\_\_\_\_\_

`thisBook.findPrice`

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

- (iii) The owner of the bookshop decides to sell gift-wrapping materials. Add the class `GiftWrap` to the class diagram on page 21, 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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**[3]**

**(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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**[3]**

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

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**[4]**

**(iii) Using an example, describe immediate addressing.**

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**[3]**

**(iv) Using an example, describe direct addressing.**

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**[3]**

**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.**

**1.** \_\_\_\_\_

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**2.** \_\_\_\_\_

\_\_\_\_\_

**3.** \_\_\_\_\_

\_\_\_\_\_ **[3]**

**(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

```
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.)

\_\_\_\_\_

\_\_\_\_\_ [1]

- (ii) State TWO reasons why views of data are used.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_ [2]

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [3]

- 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:**

<b>Photold</b>	<b>Photo reference number</b>
<b>Type</b>	<b>Colour or black &amp; white photo</b>
<b>Shootld</b>	<b>Photoshoot reference number</b>

**PHOTOSHOOT:**

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

**SALE:**

<b>Saleld</b>	<b>Sale reference number</b>
<b>Photold</b>	<b>Photo reference number</b>
<b>Customerld</b>	<b>Customer reference number</b>
<b>SaleDate</b>	<b>Date the photo was sold</b>

**(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 below or on a separate sheet to show PHOTO, PHOTOSHOOT and SALE, using only the information given.**



**(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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**[4]**

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

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

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**[4]**

**END OF QUESTION PAPER**

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