

# OCR

Oxford Cambridge and RSA

## Friday 16 June 2017 – Morning

### A2 GCE COMPUTING

#### F453/01 Advanced Computing Theory

Candidates answer on the Question Paper.

**OCR supplied materials:**

None

**Other materials required:**

- You may use a calculator

**Duration:** 2 hours



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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### 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.
- Answer **all** the questions.
- 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).
- Do **not** write in the barcodes.

### 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**.
- 'Quality of Written Communication' will be assessed in this paper.
- This document consists of **20** pages. Any blank pages are indicated.

1 (a) A printer has only a small amount of memory.

(i) State the name of the process that enables a computer sending a large printing job to manage this without stopping other processes from working.

..... [1]

(ii) Explain why this process is used.

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

(b) Virtual memory is used within a computer operating system.

(i) State the purpose of virtual memory.

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

(ii) Describe how virtual memory works.

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

(c) One component of a typical desktop operating system is the boot file.

State the name of, and describe the uses of, **two** other types of component.

Component 1 .....

Description .....

.....

.....

.....

Component 2 .....

Description .....

.....

.....

.....

[6]

(d) Scheduling is used on a multi-user system to manage throughput.

Priority is one type of scheduling.

Give **one** advantage and **one** disadvantage of Priority scheduling.

Advantage .....

.....

Disadvantage .....

.....

[2]





- 3 (a) In the classic Von Neumann architecture there are registers called the Memory Address Register (MAR) and the Memory Data Register (MDR).

Explain what the MAR and the MDR are used for.

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

- (b) State the similarities and differences between a parallel multi-core processor and an array processor.

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

- (c) State **one** advantage and **one** disadvantage of an array processor architecture over a Von Neumann architecture.

Advantage .....

.....

Disadvantage .....

..... [2]

4 (a) A real binary number may be represented in normalised floating point binary notation using 3 bits for the mantissa followed by 3 bits for the exponent, both in two's complement binary.

(i) State the largest positive value that could be stored in this format.

Your answer must be in both floating point binary and denary.



Floating point binary .....

.....

Denary .....

.....

[2]

(ii) State the largest negative value that could be stored in this format.

Your answer must be in both floating point binary and denary.



Floating point binary .....

.....

Denary .....

.....

[2]

(b) For this part of the question, 5 bits are for the mantissa and 3 bits for the exponent.

(i) Convert the denary value 0.375 to normalised two's complement floating point binary. You must show your working.

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

(ii) Convert the following normalised two's complement floating point binary number to denary. You must show your working.

1	0	0	1	1	0	0	1
---	---	---	---	---	---	---	---

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



5 (a) A print server uses a queue to store items to be processed.

Write an algorithm to retrieve the first item from the queue.

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

(b) A programmer needs to merge two sorted data files.

Explain what requirements are needed to merge two files and any assumptions that you make.

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

6 (a) There are three main types of high level programming paradigm: Procedural, Object oriented and Declarative.

Complete the table below by ticking which statement applies to which paradigm.

	Procedural	Object oriented	Declarative
Has facts			
Uses inheritance			
States how a problem is solved			
Uses rules			
One line at a time in order			
Uses methods			

[6]

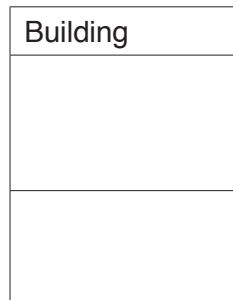
Turn over

10

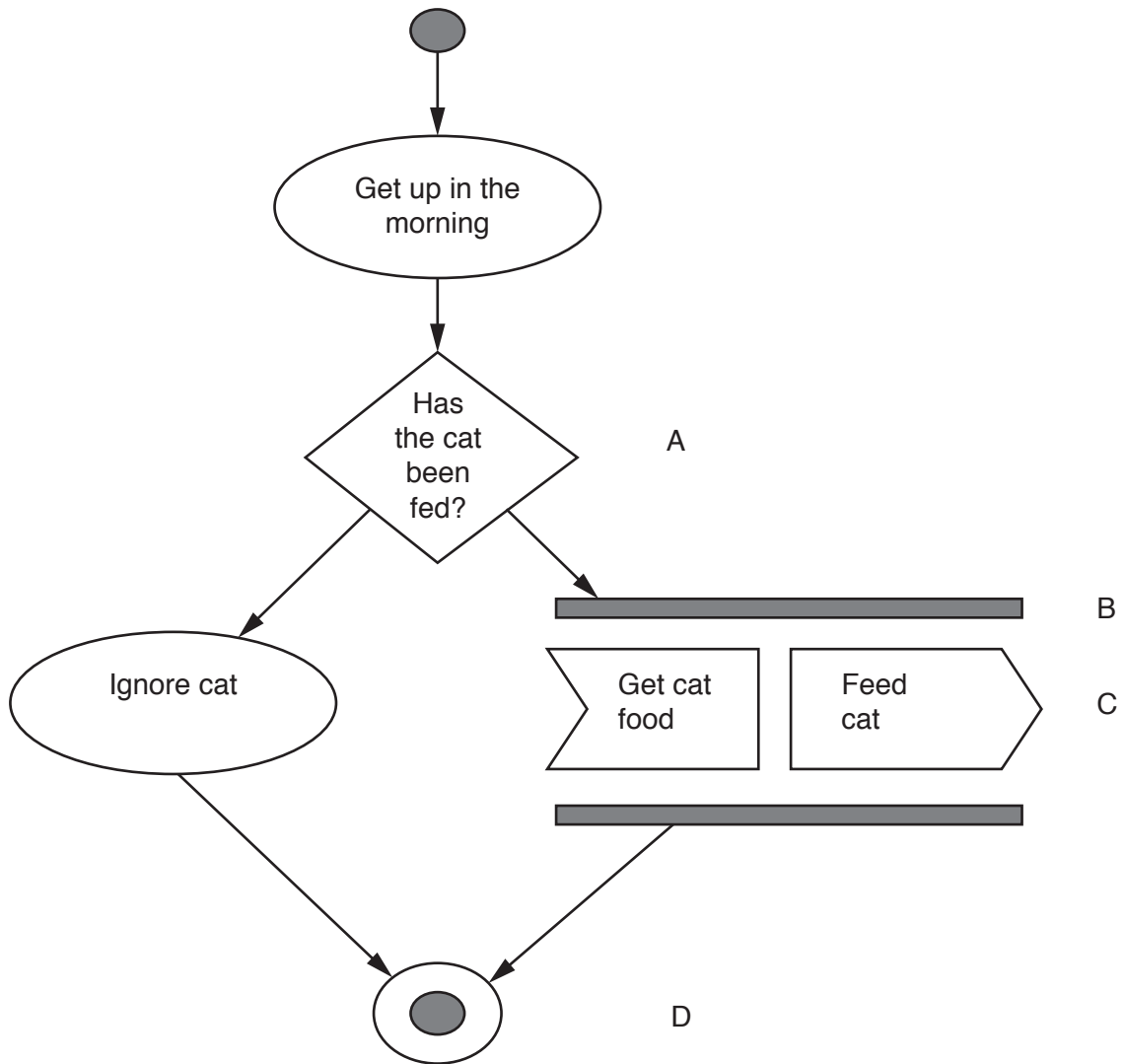
(b) A local council needs to create a class diagram for all the buildings in the area for tax purposes. Buildings are categorised as either domestic, i.e. a home or commercial, i.e. a business.

Create a class diagram for buildings:

- Include a class for Domestic that has sub-classes of House and Bungalow.
- Include a class for Commercial that has a sub-class of Factory.
- Add attributes for FloorArea and Bedrooms
- Add methods to GetFloorArea and SetBedrooms



(c) Below is a UML diagram.



(i) State the name of this type of diagram.

..... [1]

(ii) State the names of the parts of the diagram labelled A, C and D.

A .....

C .....

D .....

[3]

(iii) State what the line at B represents.

..... [1]

7 (a) A program uses functions for mathematical calculations. One such function is called `Squared(num)`.

(i) Explain by using the example `Squared(num)` how a stack could be used when the function is called from the main program.

A diagram may be used as part of your answer.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Using the example `Squared(num)`, explain the term parameter.

.....

.....

.....

..... [2]





8 (a) There are multiple addressing modes used in low level languages.

(i) State the names of **three** different addressing modes.

- 1 .....
- 2 .....
- 3 .....

[3]

(ii) Describe **two** of the named addressing modes you stated above.

- 1 .....  
.....  
.....  
.....
- 2 .....  
.....  
.....  
.....

[4]

(b) Using the example `SUB 42` explain the terms mnemonic, opcode and operand.

Mnemonic .....  
.....  
.....

Opcode .....  
.....  
.....

Operand .....  
.....  
.....

[6]

9 (a) A part of a database for a county library is defined as:

Book (BookId, Author, Title, Genre, LibraryId)  
Library (LibraryId, Region, Address)

(i) Identify the names of **two** primary keys from the tables above.

1 .....

2 ..... [2]

(ii) Identify **one** foreign key and which table it is in.

Foreign Key .....

Table ..... [2]

(b) A Database Management System (DBMS) structure is composed of three parts, these are the DDL, the DML and the Data Manager. The Data Manager contains the Data Dictionary.

(i) State the full name for DDL.

..... [1]

(ii) State the full name for DML.

..... [1]



(iii) List **six** items documented in the Data Dictionary.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....

5 .....

.....

6 .....

.....

[6]

**END OF QUESTION PAPER**

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