

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
A2 GCE
F453/01
COMPUTING
Advanced Computing Theory
WEDNESDAY 22 JUNE 2016: Morning
DURATION: 2 hours
plus your additional time allowance
MODIFIED ENLARGED 24pt

Candidate forename		Candidate surname								
Centre number						Candidate number				

Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:
None

OTHER MATERIALS REQUIRED:
You may use a calculator

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.

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).

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.

Any blank pages are indicated.

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1 (a) Operating systems can use many different scheduling algorithms.

(i) State THREE different scheduling algorithms.

1 _____

2 _____

3 _____

[3]

(ii) Explain the purpose of scheduling.

[3]

(b) Memory management in a computer for main memory can use either paging or segmentation.

(i) Explain what is meant by ‘paging’.

[2]

(ii) Explain what is meant by ‘segmentation’.

[2]

(iii) State TWO similarities between paging and segmentation.

1

2

[2]

2 Early computers were programmed in binary machine code. Today most programmers use high-level languages.

(a) Explain the advantage to the programmer of using a high-level language over machine code.

[4]

(b) Explain why the programmer could use intermediate code for the final product.

[3]

(c) Identify FOUR benefits to the programmer of using library routines.

[4]

3 A computer uses a Von Neumann processor.

(a) Describe the fetch-decode-execute cycle that this architecture uses.

Fetch _____

Decode _____

Execute _____

[3]

(b) Von Neumann architecture uses special registers to store data.

One of these registers is the Current Instruction Register (CIR).

Name TWO other special registers.

1 _____

2 _____

[2]

(c) RISC and CISC are types of processor architecture.

Describe the differences between the TWO architectures.

[4]

- 4 A real binary number may be represented in normalised floating point binary notation, using 4 bits for the mantissa followed by 3 bits for the exponent, both in two's complement binary.
- (a) (i) Convert the denary value 1.75 to normalised two's complement binary in the format described.

You must show your working.

[4]

(ii) Convert the following number to denary.

You must show your working.

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

[3]

(b) A programmer has 16 bits to use to store a real binary number.

Describe the trade-off between accuracy and range when deciding how many bits to use for the mantissa and exponent.

[4]

5 A programmer decides to use a dynamic data structure to hold items.

(a) Describe the advantages and disadvantages of using a dynamic data structure.

[4]

(b) Part of the data held is as follows:

(42, 83, 27, 18, 52)

(i) Explain why a binary search would NOT be used for this data.

[2]

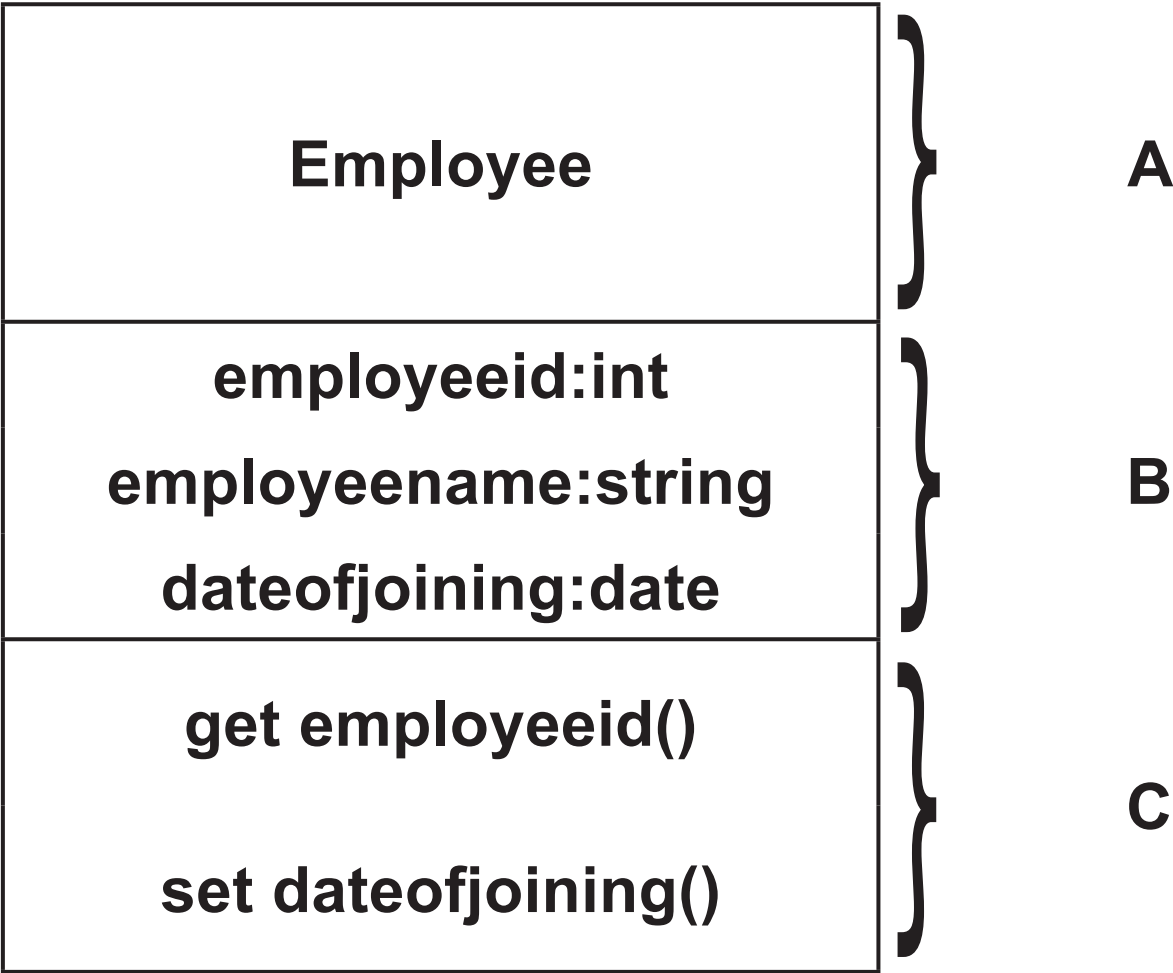
(ii) Describe the steps that a serial search would take to find the value 27.

[4]

(iii) Demonstrate the steps needed for a quick sort on these values: (42, 83, 27, 18, 52). [5]

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6 A systems analyst defines part of a company’s system using Unified Modelling Language (UML).



(a) Name the three different parts of the diagram labelled A, B and C.

A _____

B _____

C _____

[3]

(b) A similar UML diagram is used to show actual data held.

Employee1
employeeid=0274 employeename=Eyhan Rajoul dateofjoining=27022003

State the name of this type of UML.

_____ **[1]**

(c) Describe the purpose of UML.

_____ **[4]**

7 A car warning system is designed using a declarative language.

open(door)	}	W
in(key)		
off(seat_belt)		
on(hand_brake)		

beep(A,B) If open(A) AND in(B)	}	X
beep(A,B) If off(A) AND in(B)		
beep(A,B) If on(A) AND in(B)		

beep(P,Q)?	}	Y
------------	---	---

Step01 attempt to solve (P)	}	Z
Step02 finds P=door		
Step03 Set P=door		
Step04 finds Q=key		
Step05 Set Q=key		
Step06 A solution is P=door Q=key		
Step07 attempt to solve (P)		
Step08 finds P=seat_belt		
Step09 Set P=seat_belt		
Step10 finds Q=key		
Step11 Set Q=key		

(a) State whether each letter represents a goal, rule, instantiation or fact.

W _____

X _____

Y _____

Z _____

[4]

**(b) Describe backtracking using the next three steps:
Step 12, Step 13 and Step 14.**

[illegible]

[6]

8 A company employs a systems analyst to create a program for calculating wages. The data that he analyses has the following items:

Hourly rate.

Hours worked.

Tax paid.

National Insurance paid.

(a) Describe how stepwise refinement could be used to develop this program.

A diagram should be used as part of your answer. [6]

(b) The programmer given the task of doing the calculations decides to use a low-level programming language.

Explain why reverse Polish notation would be used.

[3]

Explain the term 'scope' in relation to variables within a program that calls several different procedures.

[illegible]

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- 9 (a) A processor uses a number of different registers. One of these is the Current Instruction Register.**

Describe the use of special registers and their functions during the fetch-decode-execute cycle, including jump instructions, reading from and writing to memory.

The quality of written communication will be assessed in your answer to this question. [8]

[illegible]

[illegible]

(b) Symbolic addressing is used in assembly language.

Describe symbolic addressing and why it may be used.

[4]

10 A programmer needs to design a database to hold details about customers and their orders for an online company.

(a) Describe the differences between a flat file and a relational database.

[4]

(b) A database contains three tables labelled Customer, Order and Item. Draw an Entity-Relationship Diagram for these where a Customer can have many Orders and an Order can have many Items. [3]

(c) Part of the database was designed in SQL.

Describe what will be displayed for the following code:

```
SELECT (Title, First_Name, Surname, Phone_No) FROM  
Cust_File WHERE Age > 21 ORDER by Surname
```

[4]

(d) The table named Cust_File has these fields: (Cust_ID, Title, First_Name, Surname, Email_Address, Age, Phone_No, Address1, Address2, County, Postcode).

A promotion targeting 15–18 year olds is planned.

(i) State the most appropriate field that should be used as a secondary key for this promotion.

_____ **[1]**

(ii) Explain the term ‘secondary’ key.

_____ **[2]**

(iii) An example of SQL is given as follows:

```
SELECT (Title, First_Name, Surname, Phone_No)
FROM Cust_File
WHERE Age > 21 ORDER by Surname
```

Rewrite this code to select the target audience.

[3]

END OF QUESTION PAPER

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