

Thursday 26 January 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**.
- This document consists of **20** pages. Any blank pages are indicated.

1 (a) An interrupt may occur during processing.

(i) State the purpose of an interrupt and give **one** example of a high priority interrupt.

.....

.....

.....

..... [2]

(ii) Describe the use of a data structure while interrupts are being serviced.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(iii) Explain how an interrupt is detected during the fetch-execute cycle.

.....

.....

.....

..... [2]

(b) After most interrupts, normal processing is resumed.

(i) Give **one** example of an interrupt after which processing is resumed.

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

(ii) On completion of processing an interrupt, state the steps that need to be taken before resuming the processing of the original job.

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

(c) Part of a personal computer (PC) operating system is a map of where files are stored on the hard disk.

Give the correct name for this feature and identify **three** items it stores.

Name

1.

.....

2.

.....

3.

..... [4]

2 (a) An assembler may be used to produce machine code.

(i) State the type of language that an assembler processes to produce machine code.

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

(ii) Describe machine code.

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

(iii) Describe the steps an assembler performs when producing machine code.

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

(b) When producing a program, programmers may use library routines.
Give **three** reasons why library routines are used.

1.
.....
2.
.....
3.
..... [3]

3 Computers use a number of machine architectures.

(a) (i) Describe Von Neumann architecture.

.....

.....

.....

.....

.....

..... [3]

(ii) Give the correct names for **two** other machine architectures.

1.

.....

2.

..... [2]

(b) Describe the use of the memory data register (MDR).

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Explain the use of the accumulator in a processor.

.....

.....

.....

..... [2]

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

(a) A real binary number may be represented in normalised floating point binary notation using 3 bits for the mantissa and 5 bits for the exponent, both in two's complement binary.

(i) Convert the following number to denary:

0	1	1	0	0	1	0	0
mantissa			exponent				

.....

.....

.....

.....

.....

..... [3]

(ii) Convert the denary number 0.125 ($= \frac{1}{8}$) to normalised floating point binary in the format described.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) An alternative representation is considered, using normalised floating point binary notation with 5 bits for the mantissa and 3 bits for the exponent, both in two's complement binary.

Convert the following number to denary:

0	1	1	0	0	1	0	0
mantissa					exponent		

.....

.....

.....

.....

.....

..... [3]

- (c) The following number is written in floating point binary notation using 6 bits for the mantissa and 6 bits for the exponent, both in two's complement binary.

0	0	0	0	0	1	0	0	0	0	0	0
mantissa						exponent					

Write this number in its normalised form. Show how you obtain your answer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- 5 (a) Give the stages of a binary search for the word Hull in the list

Belfast, Chester, Epsom, Hull, Kendal, Luton, Neath, Oban, Staines

.....

.....

.....

.....

.....

..... [3]

- (b) Explain **one** advantage and **one** disadvantage of a binary search compared with a serial search in any list of data.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (c) (i) Give the result of merging the following data files:

File A: Ben, Charlie, Mic, Suzi, Yasmin

File B: Adam, Ben, George, Judi

.....

..... [1]

- (ii) State **two** features of files that can be merged.

1.

.....

2.

..... [2]

(d) (i) Describe a queue data structure.

.....

.....

.....

..... [2]

(ii) State **two** uses of a queue in a computer system.

1.

.....

2.

..... [2]

(iii) State what validation must be done before adding a new data item to a queue.

.....

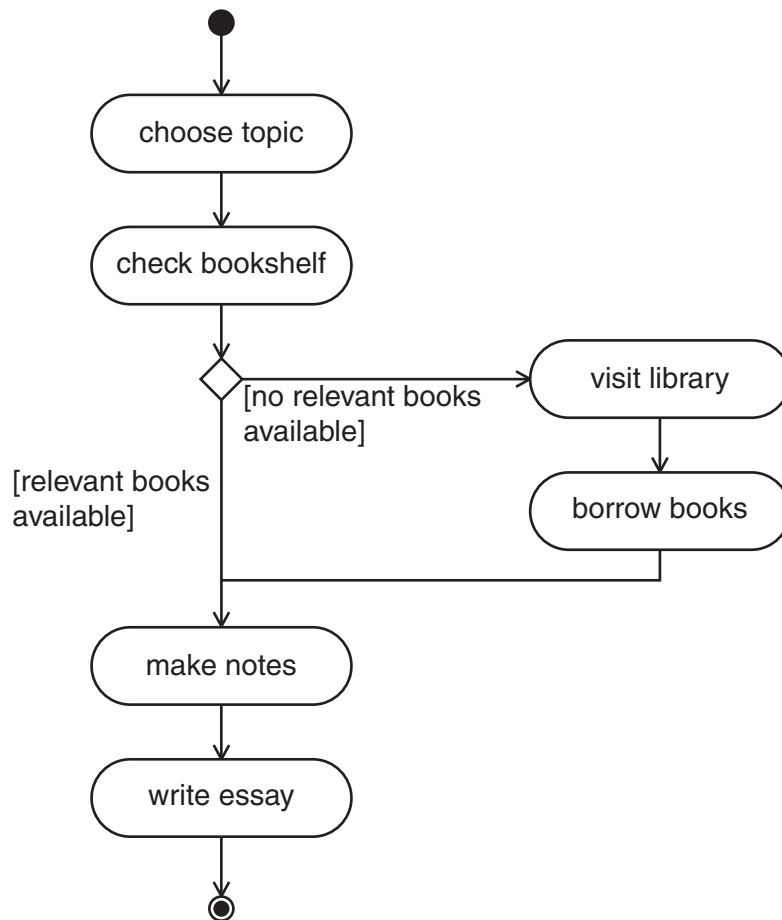
..... [1]

(iv) State what validation must be done before removing a data item from a queue.

.....

..... [1]

- 6 (a) The UML diagram shows what happens when a student prepares an essay.



State the correct name for each of the following:

this type of UML diagram

.....

what the arrows represent

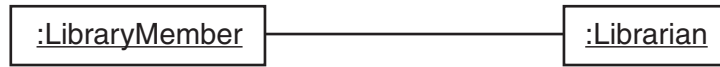
.....

the terms written in square brackets

.....

[3]

(b) A simple UML object diagram is shown below.



(i) Explain the purpose of an object diagram.

.....

.....

.....

..... [2]

(ii) Explain what must be added to an object diagram for it to become a communication diagram, and show **one** example on this diagram.

.....

.....

.....

..... [4]

7 (a) Procedures may be used to develop a program, using stepwise refinement.

(i) State **three** benefits of using procedures.

1.
.....
2.
.....
3.
..... [3]

(ii) Describe stepwise refinement.

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

(b) Some programming languages allow the use of global variables and local variables.

(i) Explain the term global variable and give **one** example of its use.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) Explain the term local variable and give **one** example of its use.

.....

.....

.....

.....

.....

.....

.....

..... [4]

8 A computer uses a number of registers.

(a) Explain why registers are used rather than Random Access Memory.

.....

.....

.....

.....

.....

..... [3]

(b) Describe the use and purpose of the program counter.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

- 9 (a) In a college, a relational database is used to store information about students and courses. Each student may study a number of courses: for example, Tom studies both “Java Programming” and “Maths for Computing”. Each course has a number of students studying it.

Explain the relationship between the entities STUDENT and COURSE. You should refer to normalisation, primary keys and foreign keys. You should include entity relationship (E-R) diagrams as part of your answer.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[8]

(b) (i) Describe a database management system (DBMS).

[4]

(ii) State **two** tasks a DBMS performs.

1.
 2.
- [2]

17
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

TURN OVER FOR THE LAST QUESTION

10 The following information about creatures is given in a particular high level language.

seal (smoky)	{smoky is a seal}	] W
seal (splash)		
seal (pipa)		
fish (herring)	{a herring is a fish}	
eats (A,B) if seal (A) and fish (B)		X
eats (P,Q) ?		Y

Part of the solution to eats (P,Q) ? includes the steps

step 1	attempt to solve	seal (P)	] Z
step 2	finds	P = smoky	
step 3	set P = smoky		
step 4	attempt to solve	fish (Q)	
step 5	finds	Q = herring	
step 6	a solution is	P = smoky, Q = herring	

(a) Give the correct name for each of the following:

this type of programming language

.....

the section labelled W

.....

the line labelled X

.....

the line labelled Y

.....

[4]

- (b) In the section labelled Z, step 6 shows that one answer has been found.

Give the correct technical term for what should happen next.

.....

List the next **three** steps of the solution, using the same notation.

.....

.....

.....

.....

.....

.....

[4]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.