

**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	
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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.
- 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.

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..... [2]

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

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..... [4]

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

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..... [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.

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..... [3]

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

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..... [4]

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

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

3 Computers use a number of machine architectures.

(a) (i) Describe Von Neumann architecture.

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..... [3]

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

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

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

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..... [4]

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

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.....  
..... [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			

.....

.....

.....

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..... [3]

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

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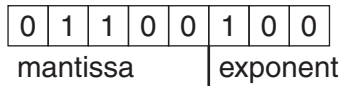
.....

.....

..... [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:



.....

.....

.....

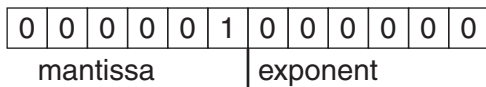
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.....

..... [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.



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

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.....

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..... [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

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

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

.....  
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.....  
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.....  
..... [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.

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

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

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

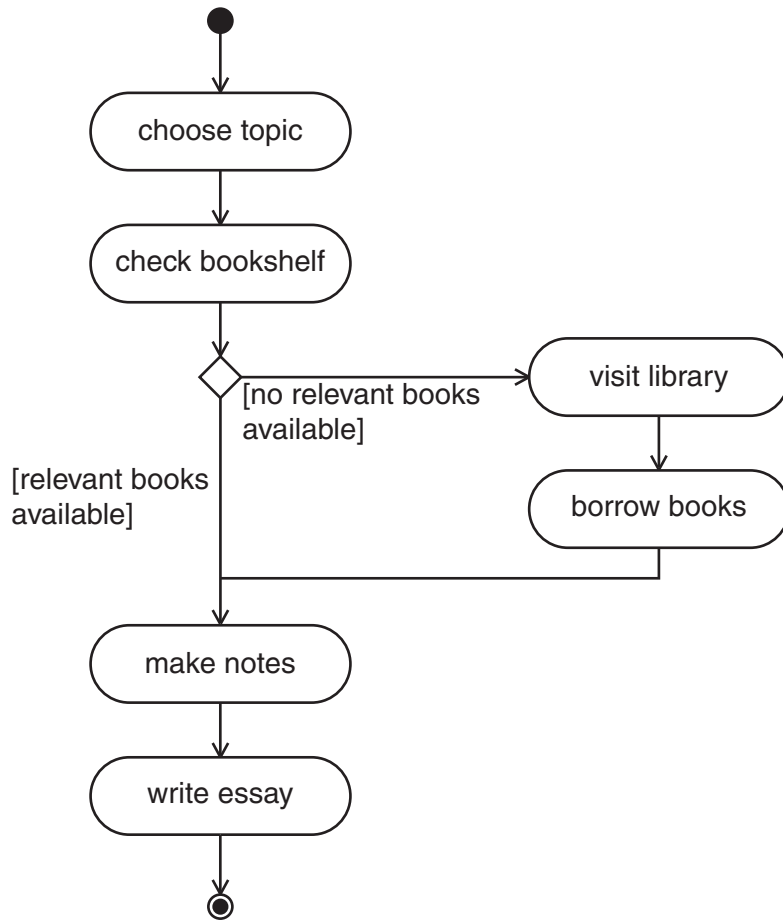
(iii) State what validation must be done before adding a new data item to a queue.

.....  
..... [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

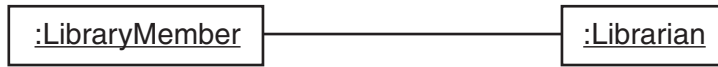
.....

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

(ii) Describe stepwise refinement.

.....  
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[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.

.....

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..... [4]

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

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..... [4]

8 A computer uses a number of registers.

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

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..... [3]

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

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..... [5]



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..... [8]

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

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..... [4]

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

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



17  
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**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.

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.....

.....

[4]

**END OF QUESTION PAPER**

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