



Tuesday 17 June 2014 – Morning

A2 GCE COMPUTING

F453/01 Advanced Computing Theory

Candidates answer on the Question Paper.

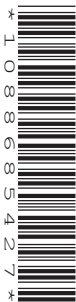
OCR supplied materials:

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.
- 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 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**.
- 'Quality of Written Communication' will be assessed in this paper.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** questions

1 (a) An operating system uses scheduling. One method of scheduling is first come, first served.

(i) Explain why the first come, first served scheduling method may **not** be efficient.

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..... [2]

(ii) Describe **one** other scheduling method.

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..... [2]

(iii) Explain why scheduling is necessary.

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..... [4]

(b) Explain why memory management is necessary.

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..... [3]

(c) Paging may be used in memory management.

Describe paging.

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[3]

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(b) State **three** benefits of using library routines when a program is written.

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[3]

- 3 (a) (i) Give the name of the computer architecture that uses the fetch-execute cycle with a single control unit.

..... [1]

- (ii) Registers used during the fetch-execute cycle include the current instruction register (CIR), memory address register (MAR), memory data register (MDR) and program counter (PC).

Place ticks in the table to show which statements are correct during processing.

	CIR	MDR	PC
Holds a binary value			
Always holds only an address			
May change more than once during a single cycle			
May pass a value to the MAR			

[4]

- (b) (i) Compare a Complex Instruction Set Computer (CISC) architecture with a Reduced Instruction Set Computer (RISC) architecture.

.....

 [4]

- (ii) Explain **one** advantage, other than cost, of RISC compared with CISC.

.....

 [2]

(c) Some computer systems use co-processors.

Explain the effect of using a co-processor system for each of the following applications.

(i) Complex calculations for scientific research.

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..... [2]

(ii) Printing personalised letters to customers for an advertising campaign.

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..... [2]

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

The following binary numbers are in the format described.

Calculate their denary values.

You must show your working.

- (i) 01010110

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..... [3]

- (ii) 01001110

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..... [3]

- (b) A real binary number may be represented in floating point binary notation using 7 bits for the mantissa followed by 5 bits for the exponent, both in two's complement binary.

- (i) State which of the binary numbers P and Q is normalised. Give a reason for your answer.

P = 101100110001
Q = 110100110011

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

(ii) The binary number R is **not** normalised. Write the normalised form of R.

You must show your working.

R = 000110100101

.....

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..... [3]

5 (a) Data structures may be described as static or dynamic.

(i) State the meaning of the term static.

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.....

(ii) State **one** type of data structure that is always considered to be static.

.....
.....

(iii) State the meaning of the term dynamic.

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.....

(iv) Give **one disadvantage** of using a dynamic data structure.

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.....

[4]

(b) The list of positive even numbers up to and including 1000 is

2, 4, 6,... 500, 502,... 998, 1000

An attempt is to be made to find the number 607 in this list.

Use the values given to show the first three steps for:

(i) a binary search

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..... [3]

(ii) a serial search

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..... [3]

(iii) Explain the difference between binary searching and serial searching.

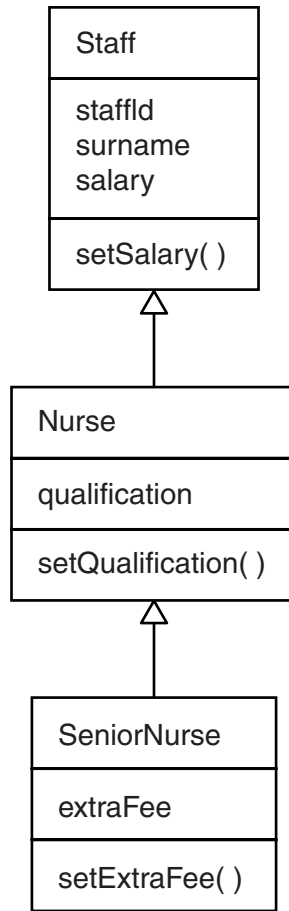
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..... [2]

(iv) State **one** advantage and **one** disadvantage of a binary search compared with a serial search.

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..... [2]

- 6 (a) A large health centre employs a number of nurses, each with a qualification. Some nurses are senior nurses, and these are paid an extra fee in addition to their salary.

The diagram below shows part of the system used.



- (i) State the type of diagram shown.

.....
 [1]

- (ii) State the term that describes setSalary(), setQualification() or setExtraFee().

.....
 [1]

- (iii) Explain the meaning of the arrows in the diagram, using an example.

.....

 [2]

- (iv) Mary Jones is a new employee at the health centre.

State why the following program statement is **not** valid.

```
Jones.setSalary(12000)
```

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

- (v) You may assume that thisSeniorNurse has been correctly defined as an object of SeniorNurse, and that x is a number.

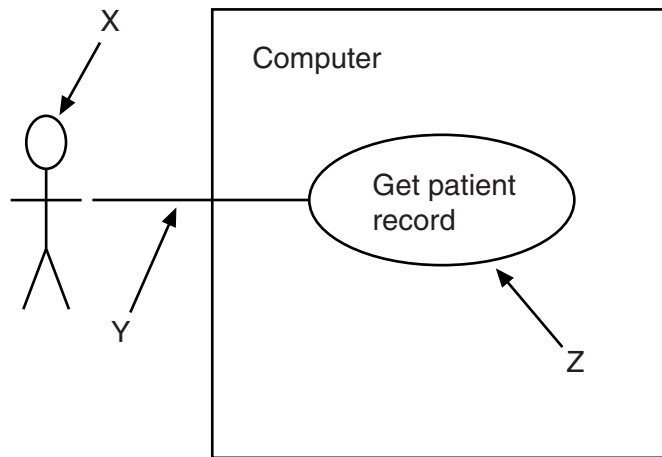
Explain why the program statement

```
thisSeniorNurse.setSalary(x)
```

is valid even though setSalary() is not shown in the SeniorNurse part of the diagram.

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..... [3]

(b) A use case diagram shows how a nurse uses the computer.



State the correct term for each feature on the diagram.

(i) the stick figure X

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.....

(ii) the line Y

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.....

(iii) the ellipse Z

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[3]

15
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Question 7 starts on page 16

7 (a) (i) A procedural programming language may use procedures.

Explain the term procedural programming language.

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..... [2]

(ii) The same variable name may be used in more than one procedure in a program.

Explain how a variable named result may be used in different procedures without causing errors.

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..... [2]

(iii) Explain parameter passing.

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..... [5]

(b) Algebraic notation may be infix or reverse Polish.

(i) Convert $(p - q)/r$ to reverse Polish.

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..... [2]

(ii) Convert stu^*+ to infix.

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..... [2]

8 (a) When writing a program, programmers may use low-level or high-level languages.

Explain why a low-level language is more suitable for programming a processor to control a washing machine.

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..... [3]

(b) Place ticks in the table to show which statements apply to the modes of addressing shown for a low-level instruction in the form **ADD 123**.

	Addressing mode			
	Immediate	Direct	Relative	None of these
123 is the address of the data to use				
ADD is an operand				
The data to use in a calculation is 123				
The address 123 holds a value which is the address of the data to use				

[4]

- (c) Caz is studying low-level languages. She has lost some of her notes on modes of addressing, but has the following part of an example.

Address in current instruction register (CIR) is 3

...

Address to be used is $3+11=14$

Name and explain **two** modes of addressing that this example could show.

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..... [4]

(b) In any relational database, primary keys and foreign keys are used.

(i) What is a primary key?

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..... [1]

(ii) Explain the use of a primary key as a foreign key.

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..... [3]

10 A particular programming language uses facts and rules. For one problem in a college, some of the program statements about students and courses are listed.

student (ben) {Ben is a student}
student (cindy)

science (computing) {Computing is a science}
science (mathematics)

language (english) {English is a language}
language (french)

studies_science (A,B) if student (A) and science (B)
studies_language (C,D) if student (C) and language (D)

The examples you use in your answers to the questions must be based on the program statements listed.

(a) Give the name for this type of programming language.

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

(b) Give **one** example of a rule.

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..... [1]

(c) Explain the term goal by writing an example.

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..... [2]

(d) Explain the term instantiation, showing how it is used.

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..... [2]

(e) Explain how backtracking is used.

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..... [2]

END OF QUESTION PAPER

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