OCR
RECOGNISING ACHIEVEMENT

Tuesday 11 June 2013 – Afternoon

A2 GCE COMPUTING

F453/01 Advanced Computing Theory

Duration: 2 hours
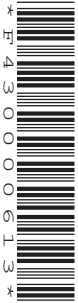
Candidate forename		Candidate surname	

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.
- 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 **20** pages. Any blank pages are indicated.

1 (a) In a computer system explain what is meant by an interrupt.

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.... **[2]**

(b) One example of an interrupt is a user interrupt.

State **two** other types of interrupt.

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[2]

(c) Explain the need for interrupts to have priorities.

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.... **[2]**

(d) (i) Segmentation may be used in memory management.

Describe segmentation.

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.... **[2]**

(ii) State the purpose of virtual memory.

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.... **[1]**

(iii) Describe how virtual memory is used.

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.... **[3]**

(iv) Explain **one** problem that may occur while using virtual memory.

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Turn over

2 (a) Different types of translator may be used by programmers.

(i) Explain the main purpose of a translator.

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.... **[2]**

(ii) Give the names of **two** types of translator and explain the main difference between them.

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.... **[4]**

(b) Describe the code generation phase of translation. Your answer should include reference to optimisation.

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3 **(a)** Describe how the contents of the memory address register (MAR) and the memory data register (MDR) change during the fetch-execute cycle.

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.... **[6]**

(b) Compare co-processor and parallel processor systems.

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.... **[4]**

4 A real 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.

(a) State which of the following binary numbers are written correctly in the format described, giving a reason for your answer.

X   1000 0111
Y   1110 0111
Z   0101 0101

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.... **[2]**

(b) For the rest of this question you must show your working and use the floating point binary format already described.

   (i) Convert the binary number 0101 0011 to denary.

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.... **[3]**

   (ii) Convert the denary number +1.5 to binary.

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.... **[3]**

(iii) Convert the denary number −6 to binary.

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.... **[3]**

5 (a) (i) Explain how a serial search can be used to find the word tulip in the list

bluebell, daisy, heather, pansy, rose, tulip, violet

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.... **[2]**

(ii) Explain **one disadvantage** of a serial search compared with a binary search in any sorted list of data.

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.... **[3]**
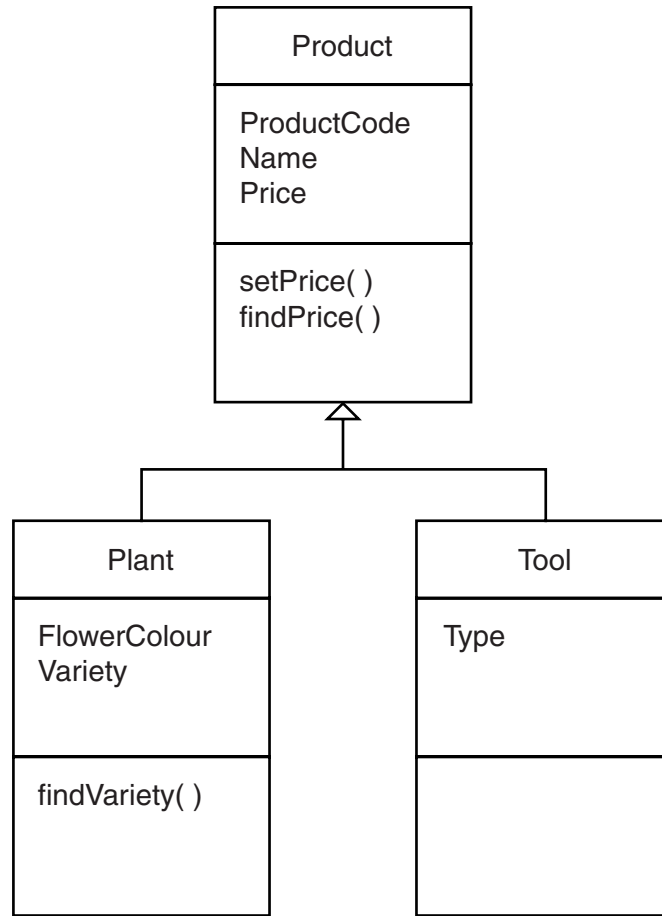
(b) (i) Give the result of merging the following data files P & Q:

File P: banana, grape, melon, pear
File Q: apple, pear, pineapple, raspberry

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.... **[1]**

(ii) Write an algorithm to merge **any** two sorted data files, stating **one** assumption you have made.

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.... **[6]**

Turn over

6 **(a)** The system used by a garden centre to store and retrieve details of its products is written in an object-oriented language. Part of the design is shown on the class diagram.

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┌─────────────────────┐
│       Product       │
├─────────────────────┤
│ ProductCode         │
│ Name                │
│ Price               │
├─────────────────────┤
│ setPrice( )         │
│ findPrice( )        │
└─────────────────────┘
          △
     ┌────┴────┐
┌──────────────┐   ┌──────────────┐
│    Plant     │   │     Tool     │
├──────────────┤   ├──────────────┤
│ FlowerColour │   │ Type         │
│ Variety      │   │              │
├──────────────┤   ├──────────────┤
│ findVariety( )│  │              │
└──────────────┘   └──────────────┘
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Explain the terms class, derived class, inheritance and encapsulation, using examples from this garden centre.

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

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(b) The following statements use a high-level language that states what to do but not how to do it.

                mouse (fluffy)   {Fluffy is a mouse}
                mouse (jerry)
                mouse (snowball)
                food (cheese)   {cheese is food}

                eats (P,Q) if mouse (P) and food (Q)

                eats (X,Y)?

(i) Give the name for this type of high-level language.

.... [1]

(ii) Give **one** example of a rule from the statements.

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.... [1]

(iii) Show the steps required to find **one** solution for eats (X,Y)?

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.... [5]

(iv) After a solution for eats (X,Y)? is found, state the name for the next step in attempting to find further solutions.

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(v) State why, in this example, Fluffy does **not** eat biscuits.

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.... [1]

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Question 7 begins on page 14

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7 (a) The diagram shows an algebraic expression written on a data structure.
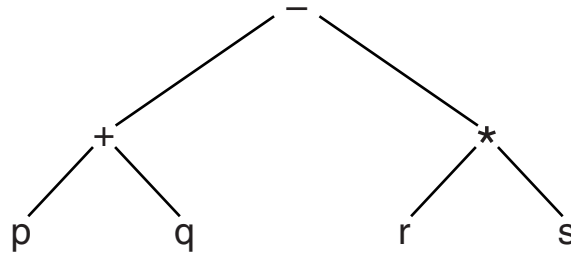
(i) State the type of data structure shown.

.... **[1]**

(ii) By traversing the data structure, give the reverse Polish form of the expression.

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.... **[3]**

(b) (i) State another type of data structure that may be used to evaluate a reverse Polish expression.

.... **[1]**

(ii) Show how this may be used to evaluate the expression

wx−y*z+

when w=3, x=1, y=4, z=5

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.... **[3]**

(c) (i) Convert each of the following infix algebraic expressions to reverse Polish notation.

(a+b)*c

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.... **[2]**

a+b*c

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.... **[2]**

(ii) State **one** reason why reverse Polish notation is needed.

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.... **[1]**

Turn over

8 **(a)** Computer architectures use registers.

Explain the need for registers.

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.... **[3]**

(b) A program is written in an assembly language. The program includes the instructions

ADD 25   add the value 25 to the contents of the accumulator
JMP 46   jump to the instruction stored at address 46

(i) Explain the purpose of the accumulator when a program is being processed.

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.... **[2]**

(ii) While the program is running, this jump instruction is stored at address 123.

Explain which **three** values are held in the program counter (PC) in turn while processing this jump instruction.

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.... **[6]**

Turn over

9 A museum has permanent displays but also runs a programme of special events. People may pay an annual fee to become Friends of the Museum. Friends can attend events, which they must book in advance. This, and other data about the museum, is stored in a relational database. Part of the entity-relationship (E-R) diagram is shown.

FRIEND ──────◁ TICKET ▷────── EVENT

(a) (i) State the type of relationship between FRIEND and TICKET.

  .... **[1]**

(ii) Explain the use of primary and foreign keys in FRIEND and TICKET.

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  .... **[4]**

(b) When the database was being designed, an initial version of the diagram showed a direct relationship between FRIEND and EVENT.

  Draw this initial E-R diagram with FRIEND and EVENT only.

  [1]

Explain why TICKET was inserted.

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.... **[3]**

(c) The database management system (DBMS) uses a data description language (DDL) and a data manipulation language (DML).

Describe the purpose of the languages.

(i) DDL

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.... **[3]**

(ii) DML

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Turn over page for part (d)

Turn over

(d) The DBMS also uses a data dictionary.

Explain the term data dictionary.

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.... **[3]**

Give **two** examples of the information stored in the data dictionary.

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.... **[2]**

END OF QUESTION PAPER