BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 6 Professional Graduate Diploma in IT

Programming Paradigms

Thursday 31st March 2016 - Morning
Answer **any** THREE questions out of FIVE. All questions carry equal marks.
Time: THREE hours

Answer any <u>Section A</u> questions you attempt in <u>Answer Book A</u>
Answer any <u>Section B</u> questions you attempt in <u>Answer Book B</u>

The marks given in brackets are **indicative** of the weight given to each part of the question.

Calculators are **NOT** allowed in this examination.

Section A
Answer Section A questions in Answer Book A

A1. a) Describe the range of tools available to support the programming development process for a team of programmers who work on collaborative projects.   **(10 marks)**

  b) Evaluate the success of these tools in improving the productivity of programmers and the quality of the code they produce. Include examples to back up any points made.   **(15 marks)**

A2. You are the Development Team Manager of a company that produces Timetable software. The development team is currently using procedural technologies and a file based data storage system. It has has decided to move to an object-oriented programming language with a database for data storage.

  Write a report to discuss the effect of using an object-oriented programming language in place of a procedural programming language. In your report, identify the concepts to be found in object-oriented languages and discuss the advantages, issues and disadvantages of taking such an approach. Illustrate your answer with appropriate examples.   **(25 marks)**

Turn over]

Section B
Answer Section B questions in Answer Book B

B3. a) Explain the terms **pure function** and **referentially transparent** expression. Give an example of each. **(8 marks)**

b) Explain the terms **domain** and **range**, as they pertain to functions in functional programming. Choose a programming language that has a square root function. What is the domain and range of the square root function? Is this a partial function or not? Explain your answer. **(10 marks)**

c) Using a functional language of your choice, write a recursive function **duplicate** which duplicates every item in a list. For example, applying duplicate to the list [3,5,6,8] should give the result [3,3,5,5,6,6,8,8]. **(7 marks)**

B4. a) Logic programming languages such as Prolog are said to be declarative. Describe what is meant by the word **declarative** in this context. Describe the advantages and potential disadvantages of declarative programming. **(10 marks)**

b) Show how Prolog determines the truth or falsehood of the goal `celebrity(victoria_beckham).` from the facts and rules in the following declarative program. Briefly describe what is meant by unification and backtracking, and give examples of the unification and backtracking that will occur when solving this goal.

```
celebrity(X) :- famous(X), alive(X).

famous(X) :- footballer(X).
famous(X) :- author(X).
famous(X) :- married_to(X,Y), famous(Y).

married_to(wayne_rooney, coleen_rooney).
married_to(coleen_rooney, wayne_rooney).
married_to(david_beckham, victoria_beckham).
married_to(victoria_beckham, david_beckham).

sister(charlotte_bronte, emily_bronte).
sister(emily_bronte, charlotte_bronte).

author(jk_rowling).
author(charlotte_bronte).
author(emily_bronte).
singer(victoria_beckham).
singer(madonna).
footballer(david_beckham).
footballer(wayne_rooney).
alive(jk_rowling).
alive(david_beckham).
alive(victoria_beckham).
alive(madonna).
alive(wayne_rooney).
alive(coleen_rooney).
```

(15 marks)

B5.   The Dining Philosophers problem describes an issue found in concurrent processes. The problem is as follows.

Five philosophers sit around a round table for dinner. They are each served a bowl of spaghetti. The spaghetti is slippery and a hungry philosopher will need 2 forks to be able to eat it, one in each hand. If a philosopher has just one fork then that philosopher cannot eat. Philosophers must think and eat, alternately. When they are ready to eat they will try to pick up two of the forks. After eating, a philosopher will put down his or her forks so that other philosophers can use them. There are just five forks on the table.

a)   What are the problems with this scenario and how do they correspond to problems raised by concurrent processes?   **(13 marks)**

b)   Explain THREE of the methods that are available to help solve the problems that you identified in part a)?   **(12 marks)**