BCS THE CHARTERED INSTITUTE FOR IT

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

Programming Paradigms

Monday 27th March 2017 - Morning
Answer **any** THREE questions out of FIVE. All questions carry equal marks.
Time: THREE hours

Answer any Section A questions you attempt in Answer Book A
Answer any Section B questions you attempt in Answer Book B

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) Explain the meaning of the terms **compiled** languages and **interpreted** languages.
(7 marks)

  b) Discuss how the following tools can support the different stages of the software development lifecycle. For each stage, supply at least ONE real-world example.

  i)   Interactive Development Environments (IDEs)

  ii)   Testing and Debugging Tools

  iii)   Configuration and Revision Control Tools

(3 x 6 marks)

A2. Imagine that you are an IT manager looking to recruit a new software developer and a new database administrator (DBA). As part of the recruitment process, applicants are asked a series of technical questions. Two sample questions are listed below – the first aimed at the developer role, the second at the DBA position. Imagine you have applied for both jobs and answer both questions.

  a) What is a **scripting language** and where, when and why would it be used? Give specific examples of scripting languages. Support your answer with specific code examples. **(10 marks)**

  b) Discuss the key differences (in terms of fundamental concepts and programming constructs) between a purely **data-oriented language** like SQL and **procedural languages** that are used with databases – such as Oracle's PL/SQL or Microsoft's T-SQL. Support your answer with specific code examples. **(15 marks)**

A3. 'Legacy Systems Incorporated' have been known as industry leaders for software development. This reputation was based on the use of procedural languages and relational databases. The company's clients are now demanding that future projects be developed within the 'object orientation' paradigm. Convince the CEO of the company that making the switch to a new paradigm is worthwhile by answering the following questions.

    a) Briefly discuss the key features and differences of **procedural** languages and **object-oriented** languages. **(10 marks)**

    b) Discuss each of the following features typically found in object-oriented languages. For each feature, using your own suitable examples, outline how it could help the company to build software systems.

        i)   Inheritance

        ii)   Encapsulation and Information Hiding

        iii)   Polymorphism

(15 marks)

Section B
Answer Section B questions in Answer Book B

B4. This question is about **functional programming**.

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

    b) Explain the term **recursive function**. Explain the main similarities and differences between recursion and iteration. **(7 Marks)**

    c) Using a functional language of your choice, write a recursive function **insert** which should take two arguments, an item and a sorted list of items, and inserts the item into the correct location in the sorted list. For example, `insert 7 [3,5,6,8]` should give the result `[3,5,6,7,8]`. **(10 marks)**

B5. This question is about **distributed systems**.

    a) What is meant by a **distributed system**? In your answer, describe communication, memory, coordination and failure. **(15 marks)**

    b) A massively multiplayer online game is one example of a distributed system. Two of the algorithmic challenges inherent in distributed systems such as this are clock synchronization and mutual exclusion. Describe what these problems are and how they may be solved in a distributed system such as a massively multiplayer online game. **(10 marks)**