

**BCS THE CHARTERED INSTITUTE FOR IT**

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

**PROGRAMMING PARADIGMS**

Friday 21<sup>st</sup> April - 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.

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**Section A**  
**Answer Section A questions in Answer Book A**

**A1.**

- a) A company is developing a new software package that will be used by businesses to manage the taxes for their employees. The software will hold information about employees in a business and details of their tax status. Businesses will enter data each month about hours worked and money paid. The software will calculate the correct taxes for each employee based on the current tax rules.

The businesses will use the software to transmit the details of the payments and taxes to the government.

The software will have a Graphical User Interface and it will be designed to run on different operating systems.

Discuss the meaning of the following items and whether the company could make use of them for this software:

- i) Event programming.
- ii) Data-oriented languages.
- iii) Scripting languages.

**(15 marks)**

- b) Discuss the benefits and purpose of standardisation bodies, such as ECMA and ISO.  
**(10 marks)**

**A2.**

- a) Using examples, illustrate the key features and advantages of using automated testing frameworks that you are familiar with.  
**(10 marks)**

- b) Define the concept of debugging and discuss how you would debug source code using debugging tools.  
**(5 marks)**

- c) Management of complex software systems is important to guarantee the functionality of software.

Discuss the value and relevance of build tools and version control systems.

**(10 marks)**

**A3.**

Using an object-oriented programming language that you are familiar with, discuss the following issues and provide examples to illustrate your answer.

- a) Show the key features and differences of overloading, overriding and polymorphism.  
**(15 marks)**

- b) Show how the concept of generalisation is used to develop reusable software.  
**(10 marks)**

**[Turn Over]**

**Section B**  
**Answer Section B questions in Answer Book B**

**B4.**

- 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)**

**B5.**

- 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_bekham)`. 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_bekham, victoria_bekham).
married_to(victoria_bekham, david_bekham).

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

author(jk_rowling).
author(charlotte_bronte).
author(emily_bronte).
singer(victoria_bekham).
singer(beyonce).
footballer(david_bekham).
footballer(wayne_rooney).

alive(jk_rowling).
alive(david_bekham).
alive(victoria_bekham).
alive(beyonce).
alive(wayne_rooney).
alive(coleen_rooney).
```

**(15 marks)**

**END OF EXAMINATION**