BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

OBJECT ORIENTED PROGRAMMING

Wednesday 16th April 2025 - Afternoon

Answer **any** FOUR questions out of SIX. All questions carry equal marks.

Time: TWO 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 **each** of the following terms in an object-oriented programming language of your choice. Write code fragments that show the syntax needed to implement each one.

Here we will define hybrid inheritance to be a mixture of any other two types.

Where appropriate, you may use the same classes to illustrate more than one inheritance example.

i. Single inheritance.
ii. Multilevel inheritance.
iii. Multiple inheritance.
iv. Hierarchical inheritance.
v. Hybrid inheritance.

(20 marks)

b) Describe and provide code illustrating an inter-class relationship other than inheritance.

(5 marks)

A2.

a) Identify and describe the **five** principles of SOLID.

(15 marks)

b) Explain **five** ways in which the concept of the Abstract Data Type (ADT) in procedural programming is similar to, or different from the concept of the class in object-oriented programming.

(10 marks)

A3.

a)

i. Describe what is meant by the following terms in object-oriented programming.

- Black box testing.
- White box testing.

ii. Explain **three** advantages and **three** disadvantages of each of the above methods.

(20 marks)

b) Explain the concept and purpose of code refactoring in software development.

(5 marks)

Section B
Answer Section B questions in Answer Book B

B4.

a) Compare and contrast the below. In your discussion include examples to illustrate your points.

i. Procedural programming.
ii. Structured programming.
iii. Object-oriented programming.

(15 marks)

b) Discuss the differences between typed and untyped languages. Provide **one** example of **each** class of language.

(10 marks)

B5.

a) Design patterns can be categorised into three main categories:

i. Structural.
ii. Creational.
iii. Behavioural.

Describe what these categories represent and give **one** example of **each** category, stating what their motivation is and the basis of the solution they offer.

(15 marks)

b) You have been asked to test an application where UML diagrams have been used to design the system.

Discuss how these diagrams can help with testing. Within your discussion provide examples of **two** different types of UML diagram to illustrate how they can help.

(10 marks)

[Turn Over]

B6.
A library needs to store the following details:

- Borrower: id, name, address, date of birth, type (child or adult)
- Librarian: id, name, address, date of birth, job title, salary, email address
- Book: bookNo, title, main author, category
- Loan: date borrowed, date due, date returned, fine (if applicable)

A borrower can have up to four books on loan in total. A fine is charged if they return the book later than the date due. The system needs to be able to register new borrowers and catalogue new books.

a) Draw a class diagram to represent this information.

(16 marks)

b) Draw **two** object interaction diagrams, **one** to represent a valid instantiation **of at least of two** of the above classes and **one** to show an invalid instantiation. Explain why they are valid or invalid.

(4 marks)

c) Explain what the **three** compartments of a UML class contain.
State how private, protected and public members are identified and provide examples of each from the above system**.**

(5 marks)

END OF EXAMINATION