

BCS THE CHARTERED INSTITUTE FOR IT
BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

OBJECT-ORIENTED PROGRAMMING

Wednesday 4th October 2023 – 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) What are the real-world practical scenarios in which procedure-oriented programming may be a more prudent choice than object-oriented programming?
(10 marks)
- b) Compare and contrast the concept of the Abstract Data Type (ADT) with that of the class.
(15 marks)

A2.

- a) Describe what is meant by the term operator overloading and suggest a real-world practical scenario in which it might be used.
(10 marks)
- b) Contrast the concept of method overriding with that of method overloading, using code fragments to illustrate your answer.
(15 marks)

A3.

- a) Describe what is meant by the single responsibility principle in SOLID, and suggest how it can be operationalised in practice.
(10 marks)
- b) Describe what is meant by the open/closed principle in SOLID, and provide a code fragment that shows how it may be implemented in practice.
(15 marks)

Section B
Answer Section B questions in Answer Book B

B4.

The British Library is a public library based in London and Yorkshire that stores over 170 million items. The library is open to visitors, but only members have access to their collections and reading rooms.

There are two types of Members, Online and Full. All members must apply for an online account, providing their personal details, such as name, address, age and contact details. Once registered, members have access to electronic items.

To gain access to non-electronic items, such as books or journals and to the Reading rooms, an online member has to apply for full membership, which involves booking an appointment with a Librarian, where they need to provide two pieces of identification. If acceptable, the member will be issued a Reader Pass, which is valid for 3 years if UK based, or 1 year if international. If a pass is still required after this time, the Full Member will have to renew their membership.

The catalogue of the library's collections can be searched online; online members can view electronic items immediately.

Full Members can view non-electronic items by booking a space in one of the Reading Rooms. To view the items the Full Member will need to order the collection items they wish to see. This can be done on the day of the booking, or in advance since some items are stored offsite and must be retrieved first. Full members can view their orders online.

Each Librarian oversees one of the collections. Each month they produce a report on the collection's statistics, such as how often the items in the collection have been requested.

- a) Draw a Use Case diagram for the library system.

(15 marks)

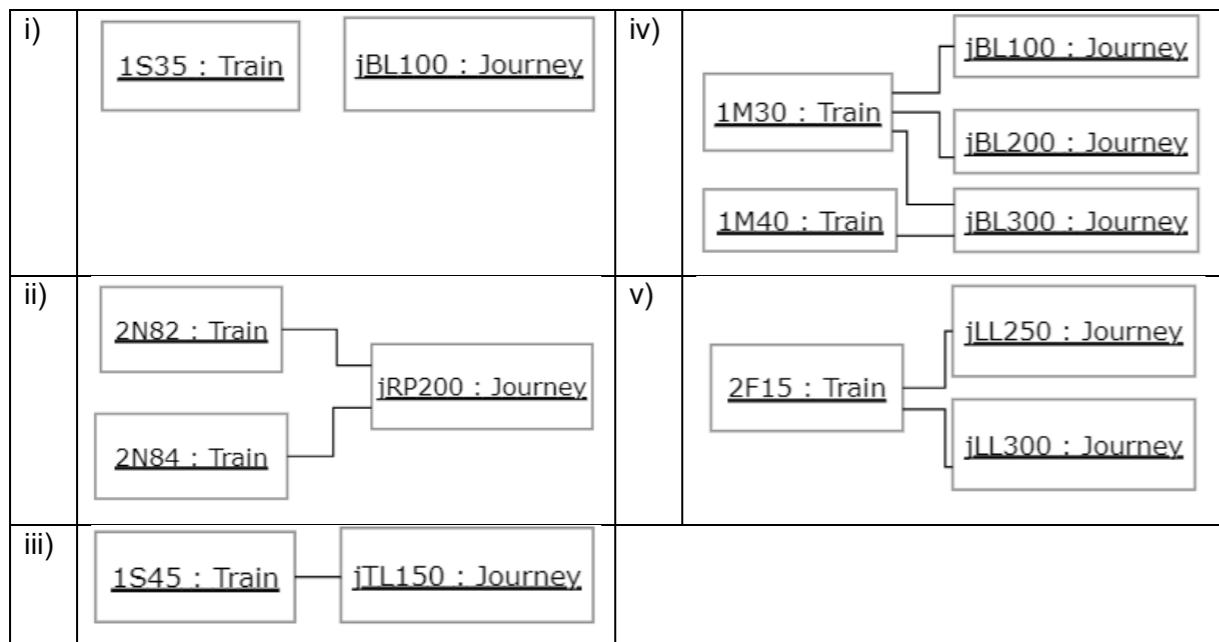
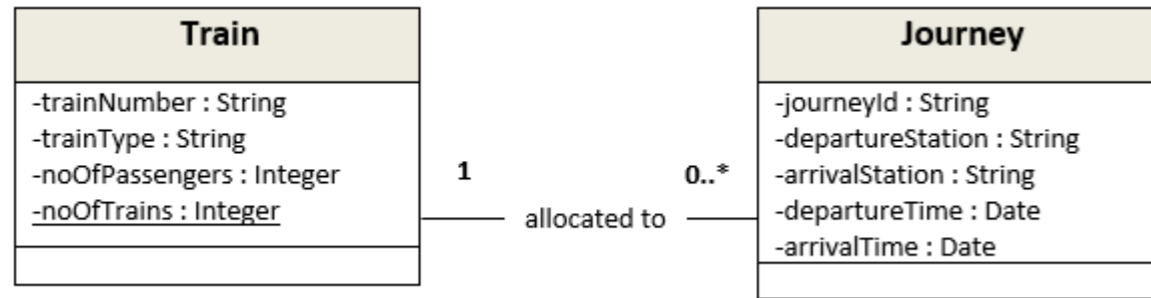
- b) Discuss why you should make use of Use Case diagrams and descriptions during the software development life cycle.

(10 marks)

[Turn Over]

B5.

- a) Given the class diagram below, state whether each of the object diagrams (i-v) are legitimate instances and explain your choice. Assume that all links in the object diagram are instances of the association shown in the class diagram.



(10 marks)

- b) In an object-oriented programming language that you are familiar with, write code to implement the class diagram above. Within your code, provide a default constructor for each class that sets the variables to appropriate initial values. The class variable should be set and incremented appropriately.

(15 marks)

B6.

- a) Design patterns can be classified according to the problem they solve, for example:

Behavioural Patterns:

Chain of responsibility, Command, Interpreter, Iterator, Mediator, Memento, Null Object, Observer, State, Strategy, Template Method and Visitor patterns.

Creational Patterns:

Abstract factory, Builder, Factory Method, Object Pool, Prototype and Singleton patterns.

Structural Patterns:

Adaptor, Bridge, Composite, Decorator, Façade, Flyweight and Proxy patterns.

Pick **ONE** design pattern from **each** of the above classifications and give a detailed description of each, stating the problem they address and the basis of the solution they offer.

(15 marks)

- b) Explain what the terms black-box testing and white-box testing mean and how they could be used to test object-oriented software. Include the advantages and disadvantages of each in your discussion.

(10 marks)

END OF EXAMINATION