

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

OBJECT ORIENTED PROGRAMMING

Monday 22nd September 2014 - 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

1. (a) Early programming languages did not support an object oriented approach to programming. Explain why and how object oriented programming languages have been developed.

(10 marks)

(b) Describe **FIVE** features you would expect to be present in an object oriented programming language. Give an example of how each feature is realised in an object oriented programming language with which you are familiar.

(15 marks)

2. (a) Explain the meaning of the term *memory management* and discuss why memory management is a necessary part of computer programming.

(6 marks)

(b) Describe the way in which memory is allocated and initialized in the object oriented programming language with which you are most familiar.

(10 marks)

(c) Some object oriented programming languages have methods which are known as destructors whilst others implement garbage collection. Compare and contrast these approaches.

(9 marks)

3. (a) In the context of the Object Constraint Language (OCL) define the following:

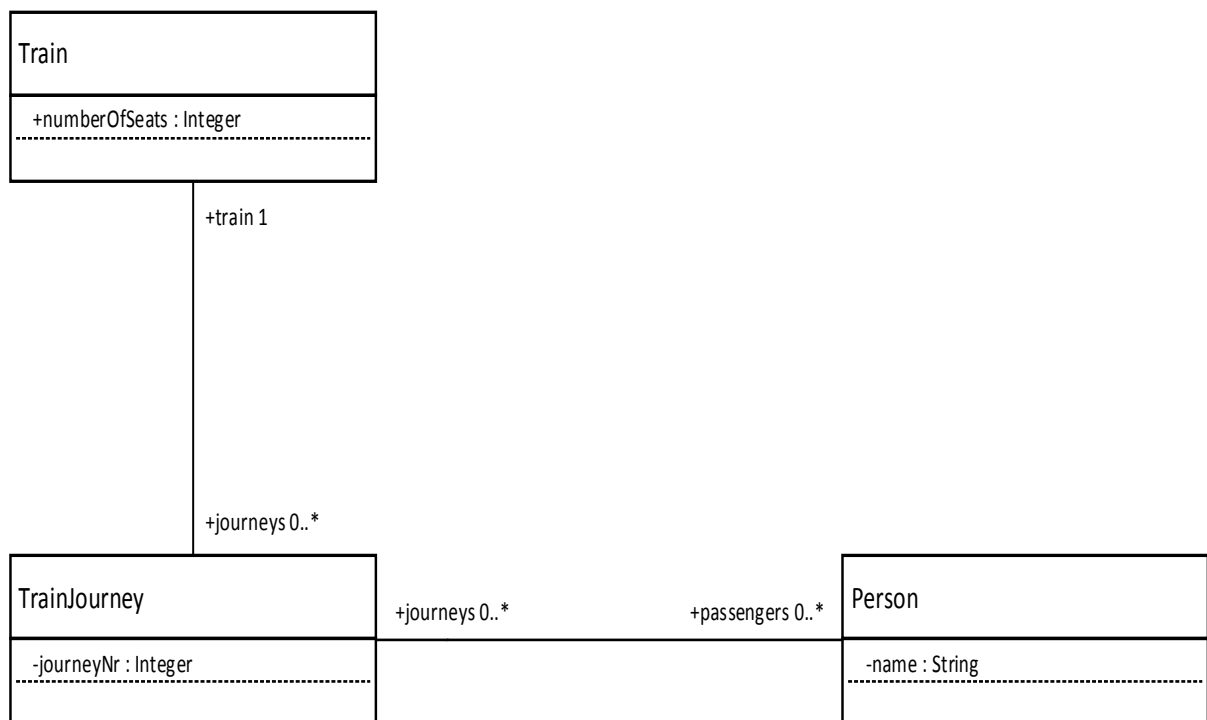
- i) Invariant;
- ii) Pre-condition;
- iii) Post-condition;

(9 marks)

(b) Explain how OCL might be used in the development of the design of an object oriented program.

(10 marks)

(c) Given the following UML diagram:



explain the following OCL statement:

context TrainJourney
inv: passengers->size() <= train.numberOfSeats

(6 marks)

Section B

Answer Section B questions in Answer Book B

4. The *Library of Birmingham* is a public library that stores various items that can be borrowed, including books, journals, music, photographs and films. The Library is open to both members and non-members, but only members can borrow up to ten items. Members must join first, by providing proof that they live in the Birmingham area. Non-members, however, can apply to use the facilities only, such as the Wi-Fi and photocopiers.

Books can be borrowed for two weeks and other items, such as music and films for one week. If the borrower keeps the item longer than this, they are subjected to a fine, which is increased daily.

When a user borrows an item, they provide their libraryNo, if this is valid their loan details are checked to ensure that they have not already borrowed above the maximum permitted number of items. A check is also made to see if they have any fines. If they have a fine, then they cannot borrow any items until the fine is paid. If all the checks are OK, then the item is issued to the user and the return date is assigned to the loan. At this point the user can optionally ask for a printout, which summaries all of the items they have on loan and when each item is due back.

Library users can reserve items that are currently out on loan. If an item proves to be very popular, then the librarian will order a new copy, provided it does not exceed the budget.

Members can register for online facilities so that they can check their own loan details at any time. Once registered, a member can also renew their loans online, provided that the item has not been reserved.

- (a) Draw a use case diagram for the library system

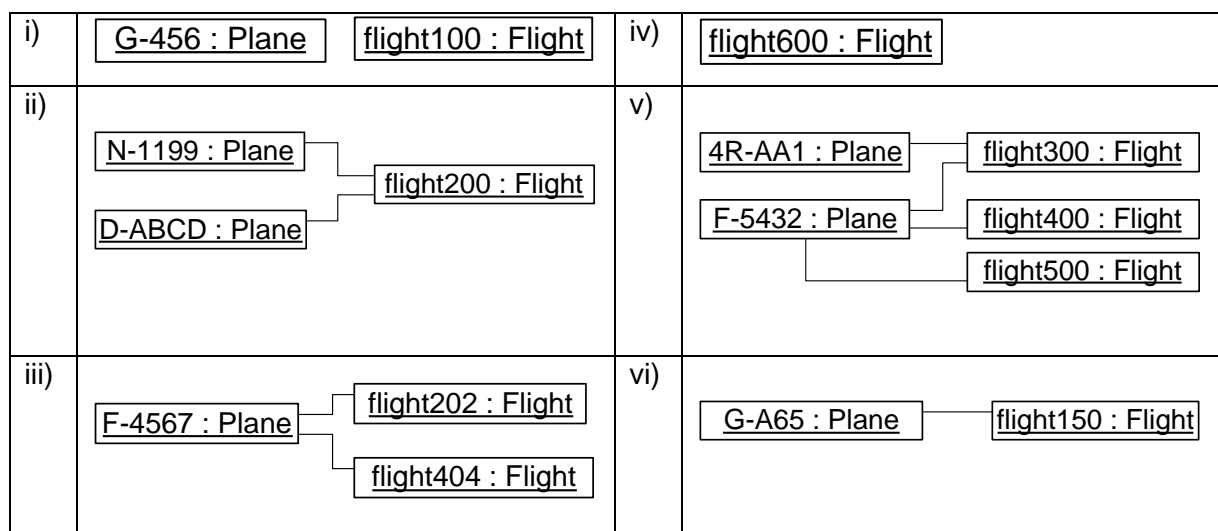
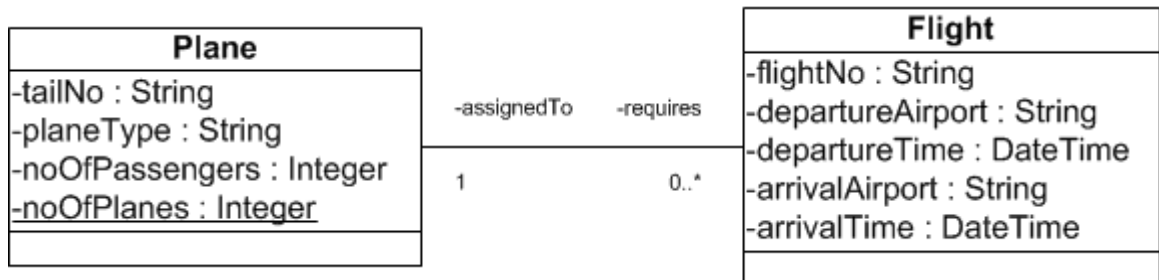
(15 marks)

- (b) Write down a use case description of the way a user borrows a book. Your answer should include a normal sequence and three alternative sequences.

(10 marks)

5. (a) Given the class diagram below, state which of the object diagrams (i-vi) are legitimate instances. Assume that all links in the object diagram are instances of the association shown in the class diagram. If an object diagram is not legitimate explain why not.

(10 marks)



- (d) 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)

6. (a) In the context of object-oriented development, what is meant by the term *design pattern*? Explain what is the motivation for using them from a programmer's point of view

(10 marks)

- (b) Explain what the terms *black-box testing* or *white-box testing* means and how they could be used to test object-oriented software. Include the advantages and disadvantages of each in your discussion and suggest other methods that can be used to test such software.

(15 marks)