

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

**OBJECT ORIENTED PROGRAMMING**

Monday 26<sup>th</sup> September 2016 - 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 <b>NOT</b> allowed in this examination.
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**SECTION A**

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

1. a) Explain how object oriented programming languages can be used to implement abstract data types. (5 marks)
- b) A deque (or double ended queue) is an abstract data type that generalizes a queue, for which elements can be added to or removed from either the front (head) or back (tail).

A deque can have any object as an element. It is characterised by four fundamental operations: *push*, *pop*, *inject* and *eject*. The push operation adds a new item to the front of the deque. If the space allocated to hold the deque is full when the push operation is attempted then an error condition is raised. The pop operation removes an item from the front of the deque. A pop reveals previously concealed items, or results in an empty deque. If the deque is empty when a pop operation is attempted then an error condition is raised. The inject operation adds a new item to the rear of the deque. If the space allocated to hold the deque is full when the inject operation is attempted then an error condition is raised. The eject operation removes an item from the rear of the deque. An eject reveals previously concealed items, or results in an empty deque. If the deque is empty when an eject operation is attempted then an error condition is raised.

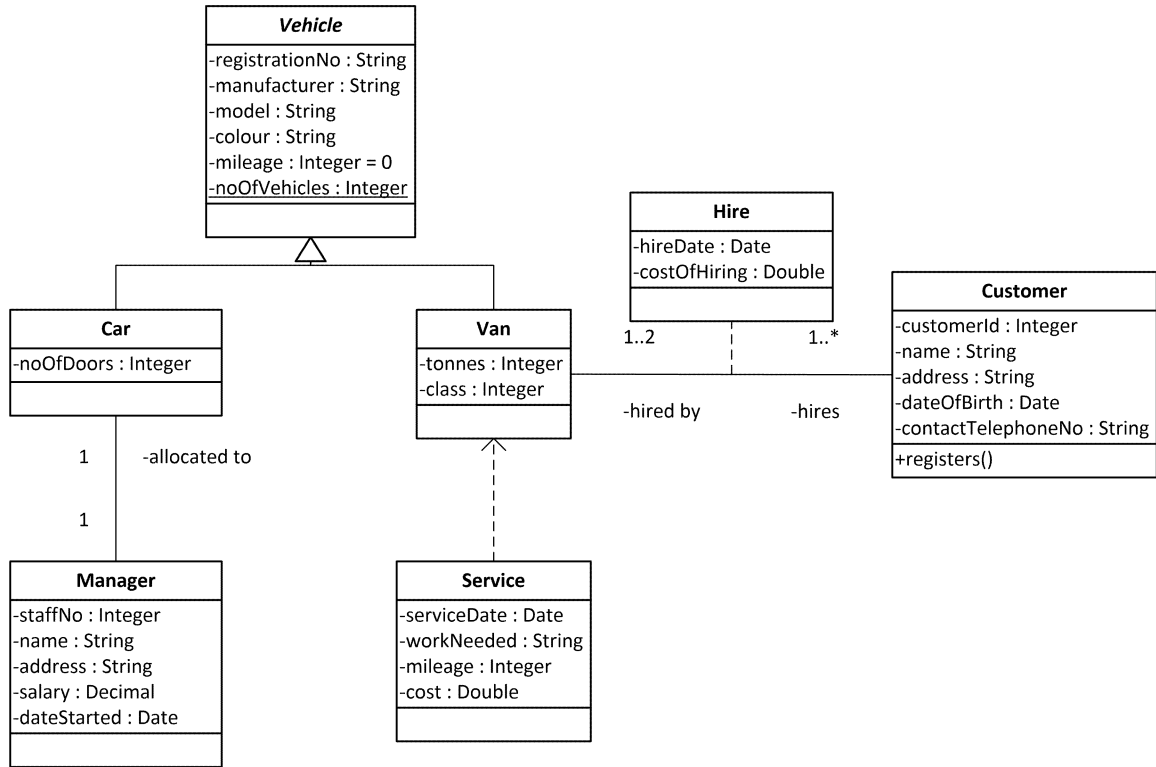
Using an object oriented programming language with which you are familiar, write code which implements a deque. Your code should store the deque elements in an array and should not make use of a deque class from a class library.

(20 marks)

2. a) Describe three modifiers which can be used to define the visibility of class members (fields and methods).  
(6 marks)
- b) Explain why it is considered good practice to limit the scope of fields and methods in object oriented programming.  
(3 marks)
- c) Explain the following terms:  
i) Inheritance;  
ii) Single inheritance;  
iii) Multiple inheritance.  
(6 marks)
- d) Using an object oriented language with which you are familiar give an example of the use of inheritance.  
(10 marks)
3. a) Explain the following terms:  
i) Object;  
ii) Encapsulation;  
iii) Fields;  
iv) Method;  
v) Message.  
(10 marks)
- b) Your local BCS branch has decided to create a web site which sets out the history of programming languages. You have been asked to provide a page on object oriented programming languages. Give an outline of how you would define an object oriented programming language on this web page.  
(15 marks)

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

4. The class diagram below represents a Van Hire system that records the hirings of a van. Managers are given a company car:



- a) Describe what the diagram above represents. Include all structural constraints.

(15 marks)

b) Given the object diagrams below (i-vi), state which are valid instances. If an instance is not valid explain why not.

(10 marks)

i.		iv.	
ii.		v.	
iii.		vi.	

5. a) When developing any system it needs to be tested. Discuss which techniques are appropriate for testing systems developed using an object oriented technology.

(10 marks)

b) Given the following classifications for design patterns:

*Creational Patterns:*

Abstract factory, Builder, Object Pool and Singleton patterns

*Structural Patterns:*

Adaptor, Decorator, Façade and Proxy patterns

*Behavioural Patterns:*

Command, Iterator, Observer and State patterns

Pick ONE design pattern from EACH of the above classifications and give a detailed description of each, which should include what the problem they address and an example of their use.

(15 marks)

6. *ABC Kids Playgroup* is an after school club for children under 12. The club wishes to keep information on the children and the staff who work there. Two types of staff are employed: Secretaries and Play Workers. Personal details, such as name and address are recorded for all staff and if they are a Play Worker they must also pass a police check. The system must record when this has been passed and when it must be renewed, because a Play Worker cannot work with the children until this condition is met.

When a child starts at the club, a Secretary records personal details such as name, address, date of birth and at least one emergency contact number, up to a maximum of three. As part of the registration process, the Secretary also records who is allowed to collect the child and their contact details. The Play Worker will use these contact details, so that they can check that the person collecting the child at the end of a session is authorised to make the collection.

Some children have special circumstances (e.g. suffers from asthma) which are treated with medication, and the Secretary will record what the condition is, what medicine can be used and what to do in an emergency.

There are different groups a child can join, after an initial assessment the Play Worker is responsible for allocating each child to a group appropriate to their age and ability.

Each week the Play Worker will generate a letter for the parents to advise them which activities their children will take part in.

At the end of each month the Secretary will generate an invoice for the parents to pay.

- a) Draw a Use Case diagram for this system.

(15 marks)

- b) Discuss the role of Use Cases (diagrams and descriptions) in the development of an object oriented system.

(10 marks)