

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

OBJECT ORIENTED PROGRAMMING

Monday 28th September 2015 - 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) Define the following terms:

- i) Data hiding;
- ii) Encapsulation;
- iii) Typed language;
- iv) Coupling;
- v) Cohesion.

(10 marks)

b) A stack is a last in, first out linear data structure. A stack can have any object as an element. It is characterised by two fundamental operations, called *push* and *pop*. The push operation adds a new item to the top of the stack. If the space allocated to hold the stack is full when the push operation is attempted then an error condition is raised. The pop operation removes an item from the top of the stack. A pop reveals previously concealed items, or results in an empty stack. If the stack is empty when a pop 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 stack. Your code should store the stack elements in an array and should not make use of a stack class from a class library. **(15 marks)**

2. Describe: the following design patterns:

- i) Iterator;
- ii) Observer;
- iii) Singleton.

For each pattern, state the motivation for the pattern, give a UML class diagram for the pattern and an explanation of the classes which participate in the pattern. **(25 marks)**

3. a) Define the following terms:
- i) Object;
 - ii) Class;
 - iii) Instantiation;
 - iv) Garbage collection;
 - v) Destructor. **(10 marks)**
- b) Explain how object oriented languages implement abstract data types. **(5 marks)**
- c) Explain how object oriented languages attempt to simplify memory management for programmers. **(15 marks)**

Section B
Answer Section B questions in Answer Book B

4. a) Discuss the role of the following UML diagrams in the development of an object oriented system. Include brief examples of their use:
- i) Use Case diagram;
 - ii) Sequence diagram;
 - iii) Deployment diagram. **(15 marks)**
- b) Discuss the techniques that can be used to test systems developed using object oriented technology. **(10 marks)**

5. A University wishes to keep information on its students. The proposed Student class has the following instance variables:

```
studentNo: String
studentName: String
dateOfBirth: Date
tariffPoints: Integer
```

Tariff Points represents the entry qualification achieved by a student, which is a number between 20 and 280.

A class variable is also required, called noOfStudents, which will be incremented each time a Student instance is created.

Using an object oriented programming language that you are familiar with, write code to perform the following, where appropriate include suitable integrity checks:

- a) Show the declaration of the Student class, including any *setter* and *getter* methods. **(15 marks)**

- b) Declare two constructors as follows; both constructors should increment the class variable appropriately:
- The first is a default constructor that has no parameters and sets the instance variables to either "not known" for the strings, 20 for the integer and 1st January 1995 for the date (assume there is a Date constructor that accepts dates in a string format).
 - The second takes 4 parameters, one for each of the instance variables.
- (8 marks)**
- c) Show how both constructors could be used to instantiate an object. **(2 marks)**

6. A private dental practice wishes to computerise its patient records system. A patient must register with the practice and the system needs to store their name, address and mobile telephone number. Each patient is given a unique seven digit patient number. The system will keep a count of how many patients the practice currently has.

Patients can book an appointment with a particular dentist; the system needs to store the date of the appointment and if the patient attended. A text message will be automatically sent out two working days before the appointment.

After the appointment the dentist update the system with the cost of the treatment undertaken.

The practice employs two types of staff: Receptionists and Dentists. The system needs to record their details; which for all staff includes a four digit employee number, their name, address, gender, contact telephone number and next of kin. Dentists must be qualified; the system will store their highest dental qualification, date awarded and their General Dental Council registration number.

A list of appointment statistics is required at the end of each week. This will be a summary of how many patients turned up and how many were no-shows. If a patient repeatedly misses an appointment they will be charged a fixed amount of money.

All receptionists must go on a first aid course every year. The system must record the date of when they last attended the course and the name of the course provider.

a) Draw a Class diagram for this system. **(20 marks)**

b) Explain what is meant by the term *refactoring* with respect to class diagrams. **(5 marks)**

