BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

OBJECT ORIENTED PROGRAMMING

Wednesday 28th March 2012 - 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.

```
class atomClass
{
  private:
    int protons;
    int neutrons;
    int electrons;
  protected:
    static int electronCharge;
  public:
    atomClass();
    atomClass(int p, int n, int e);
    void setProtons(int p);
    int getNeutrons();
};
```

a)

i) Explain the consequences of having set the neutrons data member to private. Why is it considered good practice for data members to be designated as private?

(3 marks)

ii) Under what circumstances would it be more appropriate for neutrons to be designated as protected?

(3 marks)

iii) Identify and briefly explain **ONE** example of polymorphism in atomClass.

(3 marks)

iv) Identify an accessor function in atomClass and provide an implementation for it.

(3 marks)

v) Identify the class and instance variables in atomClass, and state how many variables there would be in total if we declared 3 objects.

(3 marks)

b) If we wished to publically inherit from atomClass, explain which members would be visible in the derived class, and state their designation.

(5 marks)

c) Explain the purpose of a copy constructor, and propose how one might be implemented for atomClass, assuming that we had a full suite of accessor functions.

(5 marks)

A2. a) Differentiate between the following pairs of terms:

i) method and message

(3 marks)

ii) method overloading and method overriding

(3 marks)

iii) early binding and late binding

(3 marks)

iv) constructing and compositing

(3 marks)

v) instance and instance method

(3 marks)

b) What is the ‘yo-yo problem’ in object oriented programming?

(5 marks)

c) Why might some languages discourage or prohibit multiple inheritance?

(5 marks)

A3. a) What are member access specifiers, and how are they represented in a UML class diagram?

(5 marks)

b) What are aggregation, composition and inheritance, and how are they represented in a UML class diagram?

(5 marks)

c) What are abstract and concrete classes, and how are they represented in a UML class diagram?

(5 marks)

d) What does it mean to say that two classes are orthogonal?

(5 marks)

e) What is a singleton pattern and when might it be used?

(5 marks)

Section B

Answer Section B questions in Answer Book B

B4. a) The majority of programs manipulate data structures. How are data structures defined in object oriented programming languages?

(5 marks)

b) During the execution of a program, any data structures it uses must be assigned to some part of the computer's memory. Explain how this is achieved in an object oriented programming language with which you are familiar.

(5 marks)

c) Some data structures (such as counters) need to be initialised when they are created. Show how this initialisation can be achieved using an object oriented programming language.

(5 marks)

d) Show how the mechanism you described in part c) operates when a data structure is derived from another simpler structure via single inheritance.

(5 marks)

e) When a program has finished using a data structure, the memory it occupies can be returned to the pool of available memory. Describe a mechanism that achieves this without the programmer having to explicitly release memory.

(5 marks)

B5. a) Describe the features that differentiate object oriented programming languages from structured programming languages which do not support objects.

(10 marks)

b) You have been asked to advise the manager of an IT department on the choice of a programming language. The manager wishes to know whether the use of an object oriented programming language would increase programmer productivity. Write a report that sets out the potential benefits and disadvantages of deploying an object oriented language.

(15 marks)

B6. a) Explain what is meant by the term *code refactoring.*

(5 marks)

b) Describe the way code refactoring might be used as part of an iterative and incremental software development process.

(10 marks)

c) How would you test object oriented software?

(10 marks)