BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

OBJECT ORIENTED PROGRAMMING

Monday 23rd September 2013 - 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.

Only **non-programmable** calculators are allowed in this examination.

Section A

Answer Section A questions in Answer Book A

A1

a) Explain what is meant by the term *method signature.*

(3 marks)

b) Describe what is meant by the term *method overloading* and comment on the importance of method signatures in determining which method is overloaded. Illustrate method overloading with code written in an object oriented language with which you are familiar.

(5 marks)

c) Describe what is meant by the term *method overriding* and comment on the importance of method signatures in determining which method is overridden. Illustrate method overriding with code written in an object oriented language with which you are familiar.

(5 marks)

d) Describe what is meant by the term *operator overloading*.

(3 marks)

e) Explain how overloading and overriding contribute to the implementation of *polymorphism* in object oriented languages.

(9 marks)

A2

a) Give the meaning of the following terms:

i) Abstraction;

ii) Encapsulation;

iii) Data hiding.

(9 marks)

b) A programmer wishes to create a set of classes that implement collections (e.g. Set, SortedSet, List, SortedList). Explain how abstraction, encapsulation and data hiding can be used to create generic classes for this purpose.

(10 marks)

c) Describe the contribution that abstraction, encapsulation and data hiding make to the potential of a language to encourage software reuse.

(6 marks)

A3

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 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)

Section B
Answer Section B questions in Answer Book B

B4

A library wishes to update its computer system and needs to store the following details:

Borrower: idNo, name, address, date of birth, status (child or adult);

Librarian: idNo, name, address, date of birth, job title, salary, email address;

Book: bookNo, title, main author, category, total number of books in the library;

Loan: date borrowed, date due, date returned, fine.

A borrower can borrow up to 8 books at one time. A fine is charged if they return the book later than the date due. The system needs to be able to register new borrowers and catalogue new books.

a) Draw a class diagram to represent this information.

(16 marks)

b) Draw two object interaction diagrams, one to represent a valid instantiation of at least of two of the above classes and one to show an invalid one. Explain why the invalid one is incorrect.

(4 marks)

c) Explain what the three compartments of a UML class contain and how *private*, *protected* and *public* members are identified, giving examples, where appropriate from the above system.

(5 marks)

B5

a) You have been asked to test an application, where UML class diagrams have been used to design the system. Discuss the role of other UML diagrams in the testing process, such as use cases, or object and state-transition (or state machine) diagrams

(10 marks)

b) 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)

B6

Global University is a university that specialises in distance learning courses, where its students study their degree courses at home, rather than on campus. Each course is made up of a number of modules and the students have to pass the assessments associated with the module. Some modules have an examination that is part of the assessment, which requires the student to attend a venue to attempt the exam paper.

A system is required to handle this examination process:

An Administration Officer has to book the venues needed to hold the examinations. Most venues require an initial deposit to secure the booking, which the Administration Officer can authorise from their budget. Three months before the exam, the students are sent a list of their nearest venues and they have to pick which one they will attend. Once these are confirmed, the Administration Officer will allocate how many invigilators are needed for the examination.

On the day of the examination each student needs to register and bring proof of identify. An Invigilator will check this and for auditing purposes will record what proof was presented. After the examination is completed, one of the Invigilators will check the number of scripts matches the number of students in attendance.

After the examination is complete one of the Invigilators will send the scripts to the Administration Officer. The Administration Officer will then send the scripts to the appropriate Examiner, who will mark the scripts.

Not all students will attend the exam for various reasons and if they have a valid reason for non-attendance, such as illness, they can apply for mitigation so that they can attend the next iteration of the examination, without financial penalty.

Once marked, the Examiner will return the scripts to the Administration Officer, who will generate a list of results for the examination board.

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. Include examples where appropriate.

(10 marks)