THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS
Diploma

OBJECT ORIENTED PROGRAMMING

19th October 2005, 2.30 p.m.-4.30 p.m.
Answer FOUR questions out of SIX. All questions carry equal marks.
Time: TWO hours.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

1. *a)* Explain briefly the following terms:
   i) Structured programming
   ii) Modular programming
   iii) Abstract data types
   iv) Typed language
   v) Untyped languages   **(10 marks)**

b) Contrast the way in which classes are implemented in typed object oriented programming languages (e.g. C++, Java or C#) and untyped object oriented programming languages (e.g. Smalltalk).   **(5 marks)**

c) Define the terms *coupling* and *cohesion* and explain how these concepts contribute to the quality of a program. Show how the object oriented concept of encapsulation aids a programmer to produce good quality code when measures of coupling and cohesion are used to gauge quality.   **(10 marks)**

2. *a)* Explain what is meant by the term *method signature*.   **(3 marks)**

b) What is meant by the term *method overloading* and comment on the importance of the method signature in determining that a method has been overloaded? Illustrate method overloading with code written in an object oriented language with which you are familiar.   **(5 marks)**

c) What is meant by the term *method overriding* and comment on the importance of the method signature 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)**

3. *a)* Define the following terms:
      i)   Object
      ii)   Class
      iii) Constructor
      iv) Destructor
      v)   Memory management   **(10 marks)**

  b) The following code, written in an idealised object oriented pseudo language, shows a situation where there are two classes myClass and mySuperclass. myClass inherits from mySuperclass. Both myClass and mySuperclass have a single constructor.

```
class mySuperclass{
     private integer x

     constructor(){
            x=0
     }
}

class myClass inherits from mySuperClass {
     private integer y

     constructor(){
            y=0
     }
}
```

Describe what occurs in terms of memory allocation and value assignment when an object of class myClass is created.   **(5 marks)**

  c) Discuss the advantages and disadvantages of implementing garbage collection in an object oriented programming language.   **(10 marks)**

4. Felix Pets Ltd is a veterinary surgery, which caters for domestic animals. A pet owner can either phone the receptionist to book an appointment, or turn up to an open session in the morning.

When an owner takes their pet to the surgery they first have to register their animal to be seen by one of the vets on duty. The receptionist asks for the owner's name and the name of their pet, so their details can be looked up. If the owner is new to the surgery, or an existing owner has a new pet, their details have to be added to the system. On most occasions only one pet is brought to the surgery, but sometimes two or more can be brought in, which means all pets must be registered. Once the pets are registered they are then allocated to one of the vets on duty and the owner waits for their consultation.

When the vet is ready, the vet first has to look up the details of the owner and pet on the system. After the vet treats the animal they will write up their notes on the system, detailing any problems and the treatment given. If any further treatment is needed the vet will produce a list of medication for the receptionist to dispense. The receptionist will then produce an invoice for the owner to pay.

Some pets will have annual injections, for example, for flu jabs. Once a week the receptionist will produce a list of reminder letters to send out to owners, reminding them their pet's booster is due.

  a) Draw a use case diagram for the vet system.   **(15 marks)**

  b) Write down a use case description of the way an owner registers their pet. Your answer should include a normal sequence and two alternative sequences.   **(10 marks)**

5. *a)* In the context of object oriented development, what is meant by the term *design pattern*? **(5 marks)**

b) Explain the motivation for using design patterns from a programmer's point of view. **(5 marks)**

c) Choose THREE of the following design patterns and give a detailed description of each, stating the problem they address and the basis of the solution they offer:
   i) Adaptor
   ii) Decorator
   iii) Iterator
   iv) Observer
   v) Singleton **(15 marks)**

6. A leading UK Bank has employed you as a systems tester to work on their new on-line banking system. The system will be developed using object oriented techniques and testing is needed throughout the project life cycle. You will have to work with the developers and team leaders to develop test cases. It is envisaged the project overall will take 18 months to complete.

a) Describe briefly what different types of testing you might employ as the project develops. **(5 marks)**

b) The team leaders have asked you whether to use the techniques *black-box testing* or *white-box testing*. Explain what these terms mean and how they could be used when testing object oriented software. Include the advantages and disadvantages of each in your discussion. **(15 marks)**

c) Describe what aspects of the design process you might use to develop the plan. **(5 marks)**