

THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS BCS Level 5 Diploma in IT

OBJECT ORIENTED PROGRAMMING

29th April 2008, 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.

Calculators are NOT allowed in this examination.

1. a) The company for which you work uses object oriented programming techniques to develop all of the software it produces. Recently, the company has merged with another software house which develops all its software using structured programming techniques. Your manager has asked you to prepare a training course on object oriented programming for programmers with a background in structured programming. Give an outline of the topics the course will cover. **(15 marks)**
- b) *Coupling* and *cohesion* are two measures which are often applied to establish the quality of structured programs. Explain what is meant by the terms *coupling* and *cohesion*. How does the use of an object oriented programming language help programmers to develop code with appropriate levels of *coupling* and *cohesion*? **(10 marks)**
2. a) i) Explain the term *object*;
ii) Explain the term *class*;
iii) What is the relationship between a *class* and an *object*? Illustrate your answer with code. **(8 marks)**
- b) i) Describe what is meant by the term *instance method*;
ii) Describe what is meant by the term *class method*;
iii) Explain where it is appropriate to use an *instance method* and where it is appropriate to use a *class method*. **(8 marks)**
- c) The class *Coin* represents a monetary coin. Each coin has a monetary value (recorded as a whole number) associated with it.
- The class has two instance methods *setValue* and *getValue* which respectively set and return the value associated with the coin.
- The class has a class method that returns the current number of *Coin* objects
- Write code that implements *Coin*. **(9 marks)**

Turn over]

3. a) Most object oriented programming languages provide a class library which contains a variety of *collection classes*. Explain what a *collection class* is and the features you would expect a *collection class* to possess. **(8 marks)**
- b) Discuss the relationship between the *Iterator* design pattern and *collection classes*. **(8 marks)**
- c) Give a fragment of code which reads in 100 numbers and prints them out in reverse order. **(9 marks)**
4. a) Describe the role of a *garbage collector*. **(5 marks)**
- b) Explain the role of a *constructor*; state how its *signature* will differ from that of other methods. **(6 marks)**
- c) A class C1 contains *private*, *public* and *protected* data members called x, y, and z, respectively. A sub-class C2 is to be created by publicly inheriting from C1. Which members of C1 will be inherited, and what will their designation be (*private*, *public* or *protected*) in the sub-class C2? Provide a table to illustrate your answer. **(6 marks)**
- d) Explain the difference between *method overloading*, and *method overriding*, using an appropriate example of each. **(8 marks)**
5. a) Which class members constitute the *interface* of a class? **(5 marks)**
- b) Distinguish between *service methods* and *support methods*. **(4 marks)**
- c) Describe two possible roles of a *destructor* method. **(4 marks)**
- d) Explain the meaning of the term *encapsulation* in the context of object oriented programming. **(4 marks)**
- e) Explain why it is not possible to declare an *instance* of an *abstract class*. Illustrate your answer with an appropriate example. **(8 marks)**

6. *mp3Now* is a digital music company that operates entirely on the web. Customers browse the catalogue for the songs wanted, add them to their basket, and proceed to the secure check out. The checkout process involves, for first time users, registering a username, password, delivery address, and credit card details. For subsequent visits, this information can be retrieved using the original username and password. Once the customer's payment has been accepted, the music files purchased become available to download from the user's on-line account for a period of 7 days.

Items are charged to the customer on a per-song basis; a database of current prices is maintained by the company with modifications made at the request of the record companies (suppliers). A large number of record companies provide permission to *mp3Now* to offer their artist's work. Each record company has an individual contract with *mp3Now* stating the percentage of the revenue generated for each song sold that they expect to receive.

- a) Identify suitable classes in this system, and draw a *class* diagram showing how they are inter-related.

(15 marks)

- b) Draw *use-case* diagrams to show the roles of two actors: customer and record company.

(10 marks)