

BCS The Chartered Institute for IT
BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT
OBJECT ORIENTED PROGRAMMING

Monday 4th October 2010 – Morning

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) Compare and contrast:
- i) Object oriented programming;
 - ii) Procedural programming;
 - iii) Structured programming.
- (15 marks)**
- b) You have been invited to give a talk to trainee programmers outlining the reasons for the widespread use of object oriented programming within the software development industry. Summarise the points you would present in your talk.
- (10 marks)**

2. a) Explain the following terms:

- i) Method signature;
- ii) Method overloading;
- iii) Operator overloading;
- iv) Method overriding.

(12 marks)

b) Give the meaning of the term *polymorphism* and explain why polymorphism is an important feature of object oriented programming.

(6 marks)

c) Give an example of code which demonstrates polymorphic behaviour.

(7 marks)

3. a) Explain the following terms:

- i) Class;
- ii) Object;
- iii) Method;
- iv) Instance variable;
- v) Class variable;

(10 marks)

b) Give an example of code which makes use of both an instance variable and a class variable.

(7 marks)

c) Discuss the use of inheritance in the development of object oriented programs.

(8 marks)

Section B

Answer Section B questions in Answer Book B

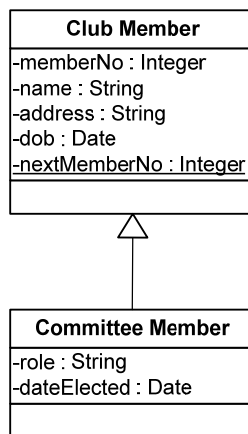
4. a) Draw a Use Case diagram for the Wrekin Athletics Running Club described in the Appendix.

(15 marks)

- b) Discuss how Use Case diagrams and scenarios contribute to the development of a system. Within your answer include an example scenario from the Wrekin Athletics Running Club.

(10 marks)

5. The following is a Class diagram that represents part of the Wrekin Athletics Running Club described in the Appendix:



- a) Using an object oriented programming language with which you are familiar with:
- (i) Write code to show the declaration of the Club Member and Committee Member classes, you do **not** need to include *setter* and *getter* methods.

(9 marks)

- (ii) Write code to declare a constructor for each class, the Club Member constructor should take 3 parameters: `name`, `address` and `date of birth (dob)`. Note that the `nextMemberNo` contains the next number that should be used for a new member and should be incremented appropriately. Committee Member should take the same 3 parameters, plus 2 additional ones for `role` and `date elected`.

Within your code show how both constructors could be invoked.

(10 marks)

- b) Discuss how the code in part (a) can be tested.

(6 marks)

6. a) Explain what is meant by the term *design pattern* in the context of object oriented programming. Within your discussion, highlight what is the motivation for using a design pattern from a programmer's point of view.

(10 marks)

- b) Design patterns can be classified according to the problem they solve. For example:

Creational Patterns:

Abstract factory, Builder, Object Pool and Singleton patterns

Structural Patterns:

Adapter, Decorator, Façade and Proxy patterns

Behavioural Patterns:

Command, Iterator, Observer and State patterns

Pick ONE design pattern from EACH of the above classifications and give a detailed description of it, stating the problem it addresses and the basis of the solution it offers.

(15 marks)

Wrekin Athletics Running Club

Wrekin Trotters is a running club for members of all abilities, from beginners to athletes who represent their country. If a new member wants to join the club they can register their details online, by providing their name, address, telephone number, and emergency contact name and telephone number.

During the week, the club runs several activities, for example, speed work and training runs. These activities are advertised in a Club Diary, which is produced and put online by a Committee Member.

During the year, the club runs a number of external events that are open to both members and non-members of the club, for example, the Wrekin Half Marathon. Runners must register for each event separately, even if they are members of the club. Entrants need to provide their name, address, date of birth, fee payable and club name. One week prior to the event, a committee member will produce a race number for the event, which is posted to the entrant. Each event has a maximum number of participants and once the limit is reached, no further entries are allowed.

For each event, several administration tasks have to be carried out by a Committee Member, such as order refreshments and medals. A record needs to be kept of the date these were ordered and the quantity. For insurance reasons, a member of the committee must also register the event with the Amateur Athletics Association (AAA).

The Club has a League for its members, the results from the club events, and other external events, are recorded online by each member and at the end of the year prizes are awarded for various categories, such as the Best Overall Senior Runner, or Best Newcomer Runner.