

THE BRITISH COMPUTER SOCIETY

**THE BCS PROFESSIONAL EXAMINATION
Diploma**

OBJECT ORIENTED PROGRAMMING (Version 1: Old Syllabus)

20th April 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 the process of *iterative and incremental development*. **(8 marks)**
 - b) How does incremental development help contain the risks inherent in system development? **(7 marks)**
 - c) Discuss the suitability of the use of object technology in an iterative development process. **(10 marks)**

2. Explain what is meant by ANY FIVE of the following used in the context of object-oriented development, giving suitable examples:
 - i) Public, protected and private visibility of class methods and attributes
 - ii) The principle of substitution
 - iii) Polymorphism and dynamic binding
 - iv) Designing to an interface
 - v) No concrete superclasses
 - vi) Templates and/or generic classes **(25 marks)**

3. **Figure 1** below is a representative class diagram that we might construct as part of an object oriented analysis and design. In the diagram we have a number of Employees that are employed by a Company. Some employees are Managers with responsibility for a team of employees. Such a typical class diagram shows class symbols, association relations and a specialisation relation.

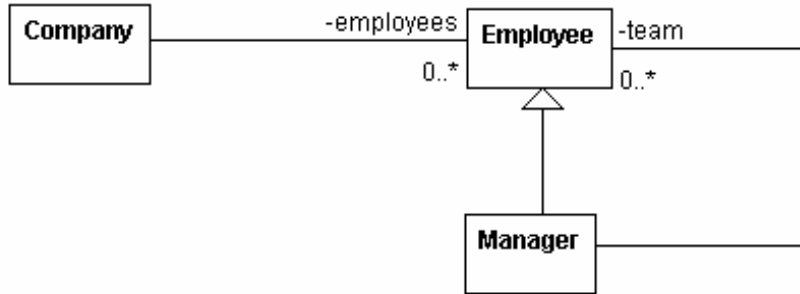


Figure 1

- a) Prepare a class diagram for a graphical computer aided software engineering (CASE) tool to compose and edit typical class diagrams (as shown above). In support of this *meta-class diagram* (i.e. a class diagram of a class diagram) you must provide an analysis of the objects in the problem and the relationships that exist between them. **(10 marks)**
- b) For each class you should propose typical features (attributes and operations) you would expect of such classes, explaining their purpose. **(5 marks)**
- c) **Figure 2** below presents a possible collaboration diagram based on the above class diagram. In it we have three employees that work for an organisation. One of these employees has a managerial role for the other two.

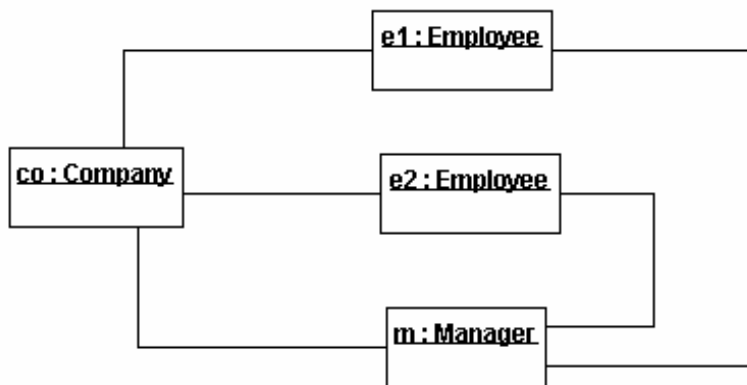


Figure 2

- i) Construct a class diagram for a graphical collaboration diagrammer. **(5 marks)**
- ii) Unify the class diagrams from a) and the diagram above to propose a single class diagram that would describe both types of diagrammer. Identify how such a CASE tool would ensure that only the correct symbols may appear in the correct diagram. **(5 marks)**

4. a) A class is required to hold employee details. The proposed Employee class has the following instance variables:

empno: String
empname: String
salary: Integer

A class variable is also required, called noOfEmployees, which will be incremented each time an Employee instance is created.

Using an object oriented programming language that you are familiar with:

- i) Write code to show the declaration of the Employee class, including any 'set' and 'get' methods. **(12 marks)**

- ii) Write code to declare two constructors, the first is a default constructor that has no parameters and sets the instance variables to either "not known" for the strings, or 0 for the integer. The second takes 3 parameters, one for each of the instance variables. Both constructors should increment the class variable appropriately. Within your code show how both constructors could be instantiated. **(8 marks)**

- b) Discuss how memory management is typically achieved in an object-oriented programming language. **(5 marks)**

5. Mississippi Books Limited wishes to implement a Web-based system to allow customers to buy their books online. The system also requires facilities to help with their stock control. The outline requirements for the system are as follows:

All customers must be registered with the system. New customers will be presented with a separate form that allows them to add their details. If they fill in all the mandatory details required, and a valid email address, they will be issued with a customer registration number. Registered customers may buy books online. Typically they will browse through details of the books available and select one or more items. If a book is out of stock it will not be displayed whilst a customer is browsing. When they have selected all the items they require they can then move to a checkout screen that enables them to enter their customer number and complete the purchase. If required, the customer can request to print the order details in a printer-friendly version.

Once ordered, the books are sent to a customer by a dispatcher. Every morning the dispatcher requests a list of books that are to be sent out. The list contains the names and addresses of all the customers who have made an order on the previous day and the books they have ordered. A buyer determines what books are for sale. A buyer can add new books to the online catalogue, put existing books on special offer or discontinue the sale of unpopular books. Each morning the buyer requests a list of those books for which the quantity in stock is lower than their re-order level. Books on this list are re-ordered. When new books arrive they are received by a warehouseman who records the new stock levels on the computer system.

- a) Draw a use case diagram for this system. **(15 marks)**
b) Develop a use case description of the way a customer orders books. Your answer should show a normal sequence and also list some alternate sequences. **(10 marks)**

6. a) Describe the following:

- i) abstract data type
ii) structured programming
iii) encapsulation
iv) untyped languages
v) typed languages

(15 marks)

- b) Choose THREE of the above concepts and discuss how each has contributed to the development of object oriented languages. **(10 marks)**