

OLLSCOIL NA hÉIREANN  
NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER II, SUMMER 2000 EXAMINATION

The B.Sc. (Honours) Degree in Computing Studies

*Advanced Programming (CT406)*

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**Time Allowed: 2 hours**  
Answer any three questions

1. (a) Design a container class *AccountManager* that manages *Account* objects. Each *Account* has a number and a balance, and may be debited or credited. Represent the design as a class diagram, and provide a sample implementation.  
  
(b) Extend the solution from part (a) to include a class that provides a global point of access to the *AccountManager*. This new class should (1) create a single instance of *AccountManager*, and (2) only allow one instance of itself to be created. Provide a sample implementation of this new class.
2. (a) Discuss the advantages and disadvantages of inheritance as a design technique.  
  
(b) Design an extendible solution for the *Employee Information System* defined below. State all design assumptions made.

On a salary scale for software developers, there are four kinds of employee: software engineer, senior software engineer, principal software engineer and consultant engineer. Each employee can have one or more qualifications (date, institution, title and result). A list of projects that an employee has worked on is also stored. Project information includes a project code, description, start and finish date. An employee can participate on many projects, and each project can have more than one employee working on it. The start date and finish date for employees on each project should be stored. Employee address details are stored (house, street, town and county), and employees can be promoted from one grade to the next at any time.

3. (a) Construct object diagrams to represent the following class associations:

- A patient (rsi number, name) is assigned to a room (code, floor)
- A student (id, name, date of birth) enrolls in a degree (code, description)
- A student (id, name, date of birth) studies subjects (code, description), where each subject can be studied by many students.

(b) For the second class association defined in part (a) of this question (i.e. student enrolls in degree):

- Draw a class diagram.
- Provide a sample implementation.

4. From the description below, produce:

- A Use-Case diagram.
- Collaboration diagrams.
- An initial class diagram that includes an *Application* class (used to startup the system).
- A refined design, based on object-oriented design principles, which ensures that the design can be easily modified and extended at some future point.

Two key transactions have been identified for a fantasy football system.

- (1) Add Owner, where an owner is described by: id, name, e-mail address and date of birth.
- (2) Add a team, where a team has a code and a name, and is linked to one (already defined) owner.