

**OLLSCOIL NA hÉIREANN  
NATIONAL UNIVERSITY OF IRELAND, GALWAY**

**SEMESTER II, SUMMER 2003 EXAMINATION**

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

**Advanced Programming (CT406)**

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Time Allowed: 2 hours  
Answer any three questions

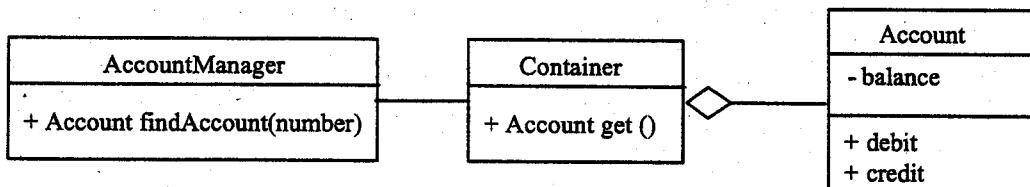
1. An object-oriented student information system must store information on students, subjects, and the result obtained by students for each subject. Sample data that would be stored in this system is shown in the following table:

Student	Subject	Result
S1	CT406	70
S2	CT406	65
S1	CT407	55
S2	CT407	75

Based on this table, produce:

- (a) A class diagram which shows all classes (including associations and multiplicities) needed to implement this system. (8 marks)
- (b) An object diagram that shows each object instance and the collaborative links between objects. Ensure that it is possible to navigate from a subject instance to the relevant student instance. (12 marks)

2. A problem has been identified with the *findAccount* method in following design. The amount of time taken to search through the container in order to find the requested account has impinged on performance. A proposal has been made to improve the access time by extending the design to include a cache that can keep track of the most recently accessed accounts (i.e. the cache must be capable of holding more than one account reference). Furthermore, the client must be totally unaware of this new caching mechanism.



Based on this:

- Produce a class diagram of your proposed solution, indicating the design pattern that is best suited to solving the problem. (10 marks)
  - For this new design, draw a collaboration diagram that shows the sequence of calls made when the method *findAccount* is invoked. (10 marks)
3. (a) Describe:
- The purpose of the Observer design pattern
  - Its structure using a class diagram
  - Its dynamic behaviour using a collaboration diagram. (8 marks)
- (b) Design the key classes of a stock monitoring system that allows subscribers to express their interest in a set of stocks, and when any of these specific stocks have been changed, the subscribers are automatically informed of these changes. (Hint: An intermediary class may be useful to perform that filtering of updates) (12 marks)

4. Analyse the following routine, and:

- (a) Draw a structure chart representation. (5 marks)
- (b) Draw a flow graph. (10 marks)
- (c) Calculate  $V(G)$  using three different methods. (3 marks)
- (d) Explain the significance of  $V(G)$ . (2 marks)

<b>routine</b>	sort routine
<b>uses</b>	Array, N (array size), sort_flag
<b>updates</b>	array
<b>description</b>	a routine which can sort an array using either <i>selection</i> or <i>bubblesort</i> algorithms

Begin

```
SET I = 0; J = 0; MIN = 0; T = 0;
IF sort_flag == SELECTION
    DO WHILE (I < N)
        MIN = I
        J = I + 1
        DO WHILE (J <= N)
            IF Array[J] < Array [Min] Then
                MIN = J
            END IF
            J = J + 1
        END DO
        T = Array[MIN]
        Array[MIN] = Array[I]
        Array[I] = T
        I = I + 1
```

END DO

```
ELSE IF sort_flag == BUBBLESORT
```

I = N

```
DO WHILE (I >= 1)
```

J = 2

```
DO WHILE (J <= I)
```

```
IF Array[J-1] > Array[J] THEN
```

T = Array[J-1]

Array[J-1] = Array[I]

Array[J] = T;

```
END IF
```

J = J + 1

```
END DO
```

I = I - 1

```
END DO
```

```
END IF
```

End Routine