UNIVERSITY *of* LIMERICK

O L L S C O I L   L U I M N I G H

COLLEGE *of* INFORMATICS *and* ELECTRONICS

Department of Computer Science
and Information Systems

End-of-Semester Assessment Paper

Academic Year:	2006/2007	Semester:	Spring
Module Title:	Systems Analysis	Module Code:	CS4125
Duration of Exam:	2.5 Hours	Percent of Total Marks:	60
Lecturer(s):	J.J. Collins	Paper marked out of :	100

**Instructions to Candidates:**

- Answer Q1, and any three other questions.

Q1   Answer ALL parts. Total marks awarded for this question: 40.

a)   What are the characteristics of good software?

4 marks.

b)   What are benefits are derived by using the pattern of Separated Interfaces?
Illustrate the answer with a package diagram.

4 marks.

c)   Briefly describe five fact finding techniques used
during requirements elicitation.

4 marks.

d)   List three problems associated with use cases.

4 marks.

e)   Draw a class diagram that depicts an order consisting of orderlines,
with each orderline being uniquely qualified by product number.

4 marks.

f)   Illustrate initialisation in the MVC architecture using a sequence diagram.

4 marks

g) Draw a class diagram that illustrates the concept of "programming to interfaces, not implementation".

4 marks.

h) What is the difference between a pattern and a framework?

4 marks.

i) List the activities that typically take place in system design?

4 marks.

j) Given the package diagram in Figure 1, what are the legal and illegal choices of class for attribute *foo* in class A?
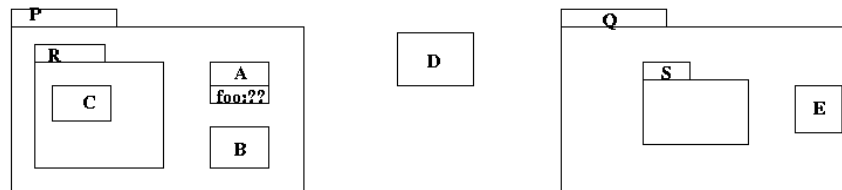
Packages and visibility examples
Figure 1.

4 marks.

Q2 Answer ALL parts. Total marks awarded for this question: 20.

a) Draw a class diagram that captures the structure and relationships of the coding fragment in Appendix A.

6 marks

b) One of the principles underpinning Design by Contract is the concept of behavioural subtyping – "demand no more: promise no less".
Explain the meaning of the phrase "demand no more: promise no less",
what is another name for this principle, and illustrate with a class diagram
using a different example to that presented in lectures.

6 marks.

c) Draw a conceptual class diagram for a student administration system, taking cognizance of the following informal specification.
   - A student is either graduating or non-graduating.
   - One or more students takes six modules.
   - Zero or more graduating students are on one HonoursCourse.
   - One or more HonoursCourses partly owns six or more modules.
   - One lecturer teaches zero or more modules.
   - A DirectorOfStudies is a Lecturer with additional duties.
   - One DirectorOfStudies directs zero or more students.

8 marks.

Q3 Answer ALL parts. Total marks awarded for this question: 20.

Agate is a public relations company that manages campaigns for clients. Its record system is a manual one, in much need of an urgent overhaul. A record is kept of each client company, and each client company has appointed one person who is the main contact person within that company. His or her name and contact details are kept in the client record in the Agate system. Agate nominates a member of staff – a director, account manager, or member of the creative team – to be the contact for each client.

Clients have advertising campaigns, and a record is kept of every campaign. One member of Agate's staff, either a director or account manager, manages each campaign. Other staff may work on a campaign such as creative staff. Agate operates a project-based management structure, which means that staff may be working on many campaigns at the same time. For each campaign they work on, they are answerable to the manager of that campaign, who may or may not be their department manager.

When a campaign starts, the manager responsible estimates the likely cost of a project and agrees it with a client. A finish date may be set for the campaign, and may be changed. When the campaign is completed, an actual completion date and the actual cost are recorded. When the client pays, the date is recorded. Each campaign includes one or more adverts that may be reused across different campaigns.

Each staff member is on a grade that determines his or her rate of salary. Agate's accountant is responsible for:
- Recording the addition of a new staff member
- Adding a new staff grade,
- Changing the rate of a staff grade
- Changing the grade for a member of staff
- Recording a client's payment.

Agate have made a strategic decision to automate their manual system, and contract you for the requirements engineering, analysis and design phases of the project. After business modelling and requirements capture, the functional requirements were specified as illustrated in Appendix B.

a)   Draw a use case diagram which models the requirements.

4 marks.

b)   Draw an analysis class diagram based on the use case model. List any further constraints that you which to include. The class diagram should include some attributes, operations, and their visibility aas deemed appropriate. Also specify associations, multiplicities, and other any model artefacts that you deem necessary.

8 marks.

c)   Draw a sequence diagram for the "add a new advert to a campaign" use case:

8 marks.

Q4   Answer ALL parts. Total marks awarded for this question: 20.

a)   Describe the key features of the object-oriented paradigm.
Illustrate the discussion with a diagram and coding fragments
for at least two features.

6 marks.

b)   Describe the concepts of coupling and cohesion.
Discuss how these concepts can be applied to an object-oriented,
and use diagrams where appropriate to ground the discussion.

6 marks.

c)   An Advert is made up of a collection of VideoClips and SoundClips.
However, one must allow client developers to invoke the operation play
upon Adverts, VideoClips, and MediaClips. Describe a design pattern
that supports the requirement that the whole-part hierarchy presents
a uniform interface to client objects.

8 marks.

Q5   Answer ALL parts. Total marks awarded for this question: 20.

a)   Produce coding fragments to illustrate the Singleton design pattern.

6 marks.

b)   Draw a class diagram and write code incorporating concepts from the pattern
of Separated Interfaces to illustrate the concept of a play button and stop button
being used by a CD player.

6 marks.

c)   What are the main issues addressed by the Model View Controller (MVC)
architectural pattern? Illustrate your answer through the use of a class diagram.

8 marks.

Appendix A

```java
interface IStack {
   void   push(Object item);
   Object pop();
}

class StackImpl implements IStack {
   protected Object[] stackArray;
   protected int     tos;  // top of stack

   public StackImpl(int capacity) {
      stackArray = new Object[capacity];
      tos        = -1;
   }

   public void push(Object item)
      { stackArray[++tos] = item; }

   public Object pop() {
      Object objRef = stackArray[tos];
      stackArray[tos] = null;
      tos--;
      return objRef;
   }

   public Object peek() { return stackArray[tos]; }
}

interface ISafeStack extends IStack {
   boolean isEmpty();
   boolean isFull();
}

class SafeStackImpl extends StackImpl implements ISafeStack {
   public SafeStackImpl(int capacity) { super(capacity); }
   public boolean isEmpty() { return tos < 0; }
   public boolean isFull() { return tos >= stackArray.length-1; }
}

public class StackUser {

   public static void main(String[] args) {
      SafeStackImpl safeStackRef  = new SafeStackImpl(10);
      StackImpl     stackRef      = safeStackRef;
      ISafeStack    isafeStackRef = safeStackRef;
      IStack        istackRef     = safeStackRef;
      Object        objRef        = safeStackRef;

      safeStackRef.push("Dollars");
      stackRef.push("Kroner");
      System.out.println(isafeStackRef.pop());
      System.out.println(istackRef.pop());
      System.out.println(objRef.getClass());
   }
}
```

Appendix B

1	*Add a new member of staff*	When a new member of Staff joins Agate, his or her details are recorded. He or she is assigned a staff number, and the start date is entered. Start date defaults to today's date. The starting grade is entered.
2	*Add a new staff grade*	Occasionally a new grade for a member of staff must be added. The name of the grade is entered. At the same time, the rate for that grade and the rate start date are entered; the date defaults to todays date.
3	*Change the rate for a staff grade.*	Annualy, the rates for grades are changed. The new rate for each grade is entered, and the rate start date set (no default). The old grade is retrieved and the rate finish date for that grade rate set to the day before the start of the new rate.
4	*Change the grade for a member of staff.*	When a member of staff is promoted, the new grade and the date on which they start on that grade are entered. The old staff grade is retrieved and the finish date set to the day before the start of the new grade.
5	*Record client payment*	When a client pays for a campaign, the payment amount is checked against the actual cost and the date paid is entered.
6	*Add a new client*	When Agate obtains a new client, the full details of the client are entered. Typically, this will be because of a new campaign, and therefore the new campaign will be added straight away.
7	*Add a new campaign*	When Agate gets the business for a new campaign, details of the campaign are entered including the intended finish date and the estimated cost. The manager for that campaign is the person who enters it.
8	*Assign staff to work on a campaign*	When a new campaign starts, members of staff are assigned to work on it.
9	*Add a new advert to a campaign*	A campaign can consist of many adverts. Details of each advert are entered into the system with a target completion date.
10	*Record completion of a campaign*	When a campaign is completed, the actual completion date and cost are entered. A record of completion form is printed out for the accountant as the basis for the invoicing client.
11	*Assign a staff contact*	Clients have a member of staff assigned to them as their particular contact person.
12	*Change a client contact*	Records when the client's contact person with Agate is changed.
13	*Record completion of an advert*	When an advert is completed, the actual date is entered.