UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

**FACULTY *of* SCIENCE *and* ENGINEERING**

Department of Computer Science
and Information Systems

**End-of-Semester Assessment Paper**

| | | | |
|---|---|---|---|
| Academic Year: | 2009-2010 | 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) Describe the benefits and liabilities arising from a commitment to upfront design using The Unified Modelling Language as typified by the Rational Unified Process.

4 marks.

b) In order to realise component based development, high level architectural decisions should be made at the start of the software development lifecycle. Provide three examples of such decisions.

4 marks.

c) Draw a diagram that captures the phases and workflows in the Rational Unified Process (RUP).

4 marks.

d) Define polymorphism. Illustrate your answer through the use of a Communication diagram.

4 marks.

e) Draw a class diagram to illustrate that an order owns orderliness, with each orderLine being qualified by productID.

4 marks.

f) What is the interpretation of the diagram in figure 1?

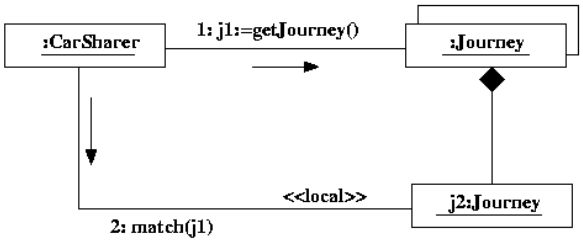


**Figure 1.**

4 marks.

g) Draw a collaboration diagram to illustrate the following dynamics: a word-processor (active object) creates a print file and then asynchronously requests a print spooler (active object) to print the job. The print spooler repeatedly reads a block from the print file and sends the block to the printer (active object) using a procedure call.

4 marks.

h) What is the purpose of a state chart? Illustrate the discussion with a diagram.

4 marks.

i) Write code or pseudocode that provides an implementation for the diagram in figure 2.

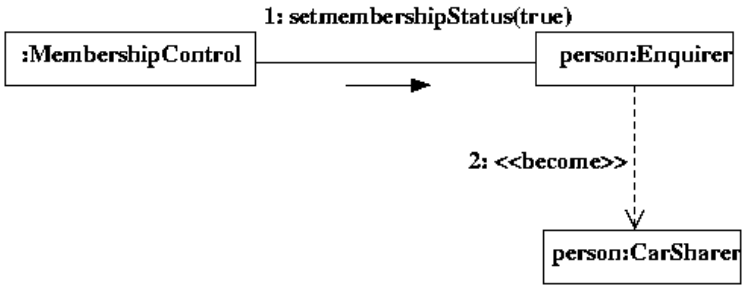


**Figure 2.**

4 marks.

j) List four services typically offered by a Database Management System (DBMS).

4 marks.

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

a) List the steps for the specification of an analysis class diagram using Data Driven Design (DDD), use case realisation. Explicit reference should be made to Boundary, Control, and Entity classes. Discuss when one might consider opportunities for applying generalisation, composition, and the specification of interfaces.

6 marks.

b) Why are diagrams of such importance in the field of information systems development?

6 marks.

c) Discuss how interfaces in the Unified Modelling Language support the concept of contracts in software engineering. Illustrate the discussion with a class diagram that demonstrates the principle of “programming to interfaces, not implementation”.

8 marks.

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

a) State the Liskov Substitution Principle, and illustrate with a class diagram.

6 marks.

b) Describe two types of coupling and three types of cohesion as described by Coad and Yourdon (1991), that apply at the class level.

6 marks.

c) Briefly describe eight activities in system design.

8 marks.

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

a) Identify the problems with the coding fragment in figure 3. Rewrite the code to resolve the problems identified, using dependency injection to reduce the coupling between person and address.

6 marks.

b) Illustrate the key points of the Singleton design pattern using coding fragments or pseudocode or a class diagram.

6 marks.

c) Briefly describe how the state design pattern separates out state dependent variation in behaviour. Illustrate the discussion with an example.

8 marks.

```
class address
{
  private int tel;
  public void set_tel_no(int number) {tel = number;}
  public void display_tel_no() { System.out.println(" Tel number is: " + tel);}
};

class person extends address
{
    private int dob;
    public void set_dob(int date) { dob = date;}
    public void display_dob() { System.out.println(" Date of birth is: " +  dob);}
}

class client {

  public static void main(String args[]) {

    person p = new person();
    p.set_tel_no(12345);
    p.set_dob(121212);
    p.display_tel_no();
    p.display_dob();
    p.display_tel_no();
  }
}
```

**Figure 3.**

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

a) What is the difference between an open and closed architecture, Illustrate the answer with a diagram.

6 marks.

b) Describe the intent of the Model View Controller (MVC) architectural pattern. Illustrate the discussion with a class diagram.

8 marks.

c) Illustrate the initialisation of the MVC architectural pattern using a sequence diagram.

6 marks.

**Q6** 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 Table 1.

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

6 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 as 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:

6 marks.

**Table 1**

| | | |
|---|---|---|
| **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 today's date. |
| **3** | ***Change the rate for a staff grade.*** | Annually, 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 changes. |
| **13** | ***Record completion of an advert*** | When an advert is completed, the actual date is entered. |