NATIONAL UNIVERSITY OF SINGAPORE

SCHOOL OF COMPUTING

SEMESTER 1 (2007/2008)
EXAMINATION FOR

CS2103 – SOFTWARE ENGINEERING

NOVEMBER 2007 Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. This examination paper contains **SIX (6)** questions and comprises **SIXTEEN (16)** pages, including this page.
2. Answer **ALL** questions within the space in this booklet
3. This is an Open Book examination.
4. Please write your Matriculation Number below.

MATRICULATION NO: ______________________________

This portion is for examiner's use only

Question	Marks	Remarks
Q1 (6 marks)		
Q2 (5 marks)		
Q3 (9 marks)		
Q4 (8 marks)		
Q5 (12 marks)		
Q6 (15 marks)		
Total (55 marks)		

Question 1 (6 marks)

(i) What are the main differences (any two) between a domain model and class diagram developed during design phase?

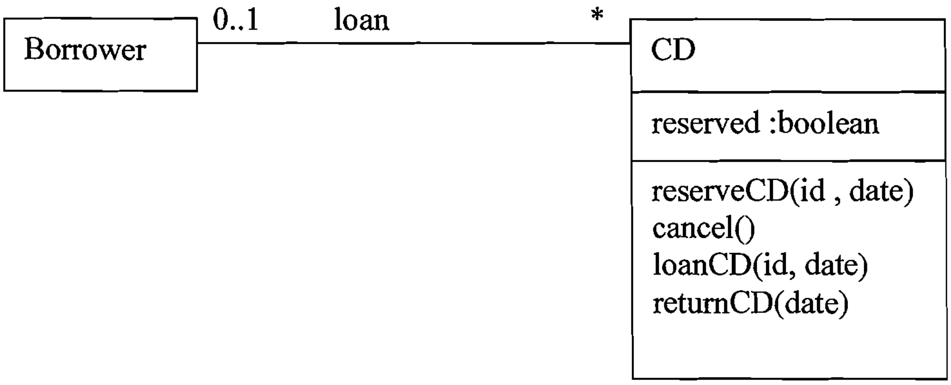
(ii) One of the factors a designer takes into account while constructing a design class diagram is to consider the cohesion factor of a class. State two other factors a designer should take into account while constructing a design class diagram.

(iii)Give examples or otherwise explain changes that need to be made to a domain model to reflect the factors stated as answer in part (ii) above.

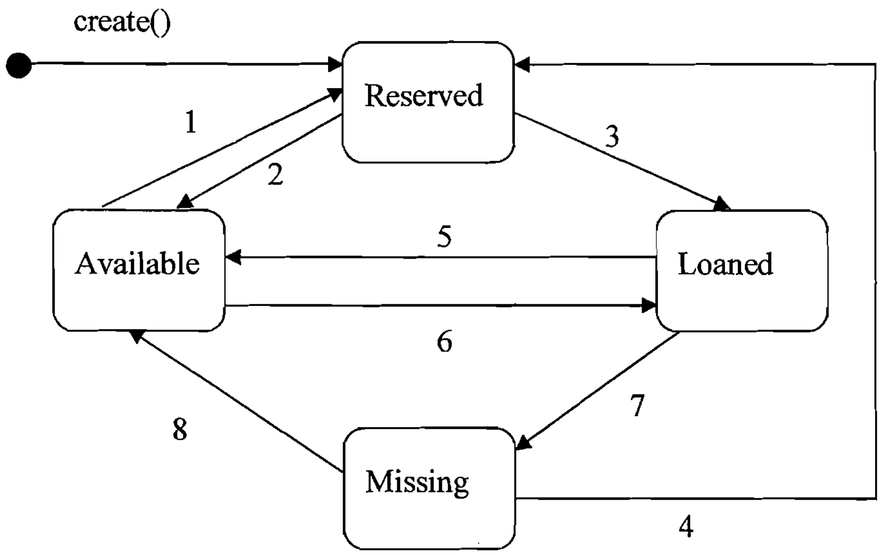
Question 2 (5 marks)

The following diagrams have been generated during the design stage of a project, the purpose of which is to develop a software to support the operations of a CD Rental Application:

part of the class diagram



State chart for CD



1. reserveCD(id, Date)
2. cancel()
3. loanCD(id)
4. returnCD(date)
5. returnCD(id)
6. loanCD(id, date)
7. today > DueDate
8. returnCD(date)

A software engineer reviewed the state chart, and indicated that there are ambiguities in the state chart as well as inconsistencies w.r.t. the class diagram. Identify at least 5 components where the state chart is inconsistent with the class diagram or is ambiguous. Explain (by way of clearly stating or drawing corrections) why the diagrams are inconsistent or ambiguous with respect to these components. Do state, if you are making any assumption from your domain knowledge.

Question 3 (9 marks)

A software is required for managing team projects for students in the module CS2103.
You are assigned the task of domain analysis for the following part of the requirements:

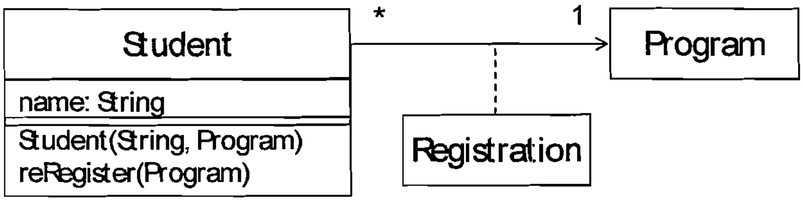
- A student is a member of exactly one team.
- Each team member has a name and a password.
- Each team has a number of documents relating to the project.
- One team member only may add, modify and delete any particular document.
The name of the person adding a document must be recorded along with the document.
Each document has a date and contents and may be marked temporary or final.
- Each student within a team has his/her own diary in which he/she may enter appointments.
- Each appointment has a date, a start time, an end time, a textual description, and may be marked as tentative or confirmed.
- For each team there is a diary which holds appointments relating to all members of the team.
- Appointments in each team diary can only be made by team members. The name of the student making a team appointment must be recorded along with the appointment.
- Team appointments must also be recorded in the diaries of the members of the teams.
- Team members may cancel personal appointments in their own diary as well as team appointments.
- The system is maintained by a TA, who can add and remove personal and team diaries, set up and modify teams, and add and remove team members.
- The TA can view documents relating to a particular team.

Draw a domain class diagram(you may use space on next page) showing the main classes and associations in the problem domain of the above requirements. For each association in the diagram, specify its multiplicity and clearly label it. Also include any relevant attributes to the appropriate classes.

{space for answer 3}

Question 4 (8 marks)

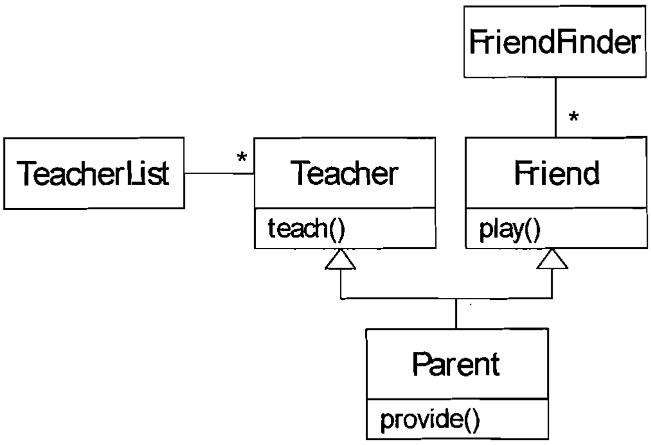
(Part I) A student is allowed to register for one, and only one, program at a time. However a student may change the program later (i.e., re-register for another program) The association class called Registration tracks the details about registrations of students in programs. The following diagram models this situation.



(a) Convert the above design into a form that can be implemented in Java. (**2 marks**)
(b) Give a possible implementation for the Student class. Be as defensive as possible in your solution (**3 marks**).

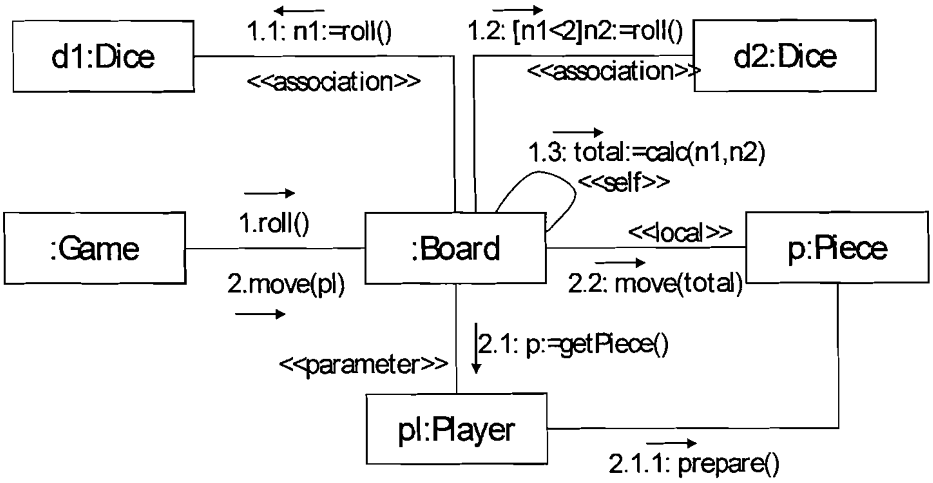
(Part II) A C++ programmer came up with the below design, to enable a Parent object to play the role of a Teacher as well as a Friend. But since Java does not support multiple inheritance, you have been asked to adapt the design to suit Java. Give an alternative design that still enables a Parent object to play the role of a Teacher as well as a Friend. For example, you design should allow to write code similar to below. (**3 marks**)

```
Friend f = new Parent();
f.play()
Teacher t = new Parent();
t.teach();
...
```



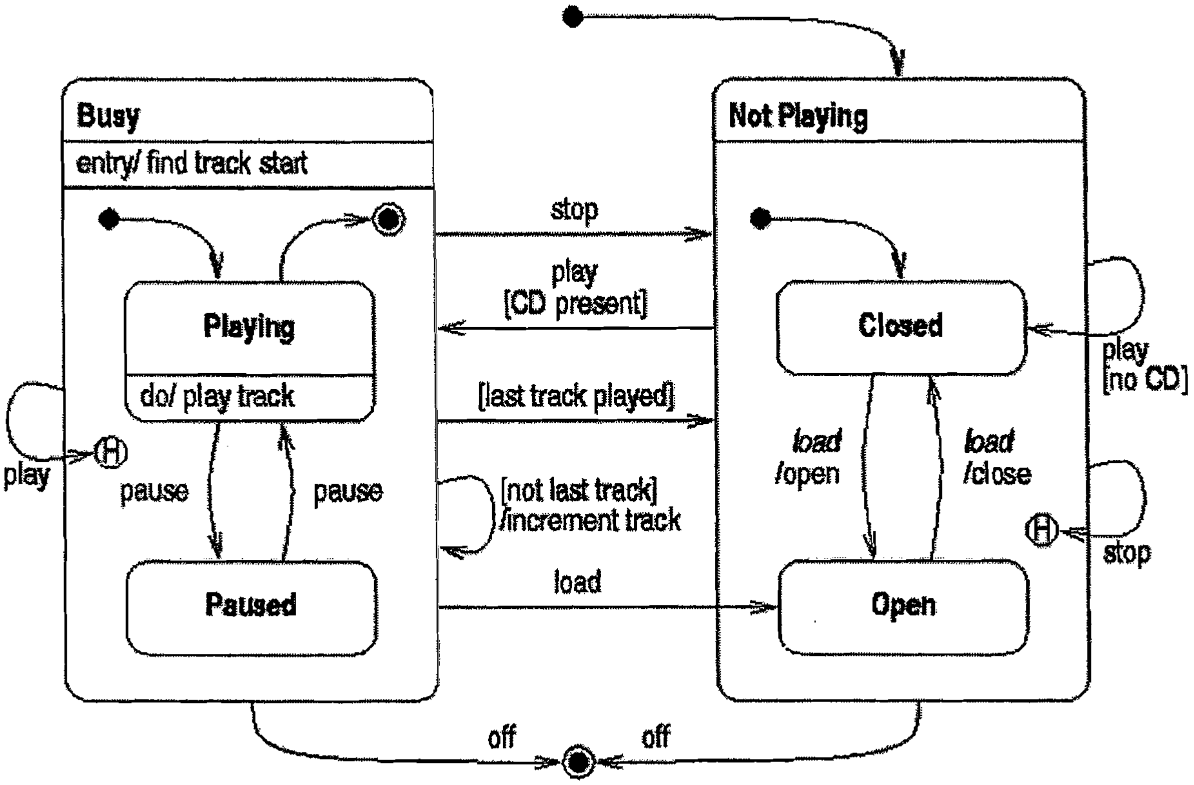
Question 5 (12 marks)

(a) Based on the collaboration diagram given below, implement the roll method and the move method of the Board class. You should declare appropriate attributes for the Board class, but you may omit constructors and other methods. (**4 marks**)



```
Class Board{
//put your variable  here


void roll(){
        //implement your method here








} // end roll
void move(Player pl){
        //implement your method here






 } // end move
 // omit other methods
} // end class
```

(b) Implement the stop method for CDPlayer class given below, using the switch-case approach (**5 marks**).



```
public class CDPlayer {
   //put your variables here




   public CDPlayer() {
      //complete the constructor





   }//end of constructor
```

// continued

```
        public void stop(){
           //complete this method















        }//end of stop method

      //omit the other methods
}//end class
```

(b) Draw the class diagram that implements the above state chart using the state pattern. For simplicity, you may ignore the requirement to keep track of the history state. (**3 marks**)

Question 6 (15 marks)

(Part I)

(a) Given below is the overview of the method dispatch(Resource,Task), from an emergency management system. Write an operation contract for the method. (**4 marks**)

Header: dispatch(Resource r, Task t):void

Overview: This method dispatches the Resource *r* to the Task *t*. Since this can dispatch only one resource, it needs to be used multiple times should the task need multiple resources.

Preconditions:

Postconditions:

(b) Imagine you are designing test cases to test the method dispatch(Resource,Task) described in (a) above. Taking into account equivalence partitions and boundary values, which different inputs will you combine to test the method? One example is given below. Add your own to the same table. **(2 marks)**

Test inputs for Task	**Test inputs for Resource**
• a fully dispatched task	

(Part II)

(a) Draw the control flow graph (CFG) for the method given below. Note that a break is missing (When there is no break at the end of a case block, execution continues until the next break). (**4 marks**)

```
public void ticket(double cost, double bal, int state) {
      switch (state) {
        case 0:
          state = 2;
          // break missing here
        case 1:
          if(bal<cost){
            state = 2;
          }else {
            state  = 0;
          }
          break;
        case 2:
          state = 1;
          break;
      }
  }
```

(b) what is the MCC for this CFG? (**1 mark**)

(c) List independent basis paths for the above CFG. For each realizable basis path, also give test data to execute the path, and expected result. (**4 marks**)

path	realizable (Y/N)?	Input values			Output values
		Cost	bal	state	state

---END-OF-PAPER---