NATIONAL UNIVERSITY OF SINGAPORE
SCHOOL OF COMPUTING

Semester I: 2000-2001
EXAMINATION FOR

CS2103/CS2103S – SOFTWARE ENGINEERING

November 2000 - Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. This examination paper contains **four** questions and comprises **four** printed pages.

2. Answer **ALL** questions.

3. Begin each question on a new page.

4. This is an open-book examination.

QUESTION 1 (40%)

FriendlyAir wishes to install a software to manage its frequent flyer program called FanClub. Members of FanClub enjoy benefits offered by FriendlyAir such as free upgrading of flight class and free flights. To sign up as a member, a customer submits an application form to FriendlyAir which details his name, identity card number, address, and telephone number. Upon approval by the FanClub customer service department, an account will be created in the FanClub software system for the member. In addition, a membership card with a unique member number will be mailed to the customer.

When the member checks in at the airport, a flight record will be updated under the member's account. The flight record contains information such as the flight number, date, and time of the flight. At the end of every month, a mileage report will be mailed to every member detailing all the flight records of the member, the mileage earned for each flight, the total mileage accumulated, the total mileage used to enjoy benefits, and the total unused mileage. A member can also check his records through a FanClub customer service representative.

To enjoy the FanClub benefits, a member must have accumulated enough mileage. A member selects a benefit by calling a FanClub service representative or informing a FriendlyAir agent while booking a flight. If the member has enough unused mileage to enjoy the benefit, the benefit will be granted and a claim record will be created in FanClub software system. The benefit claim record contains information such as the type of benefit and the date of claim.

The FanClub software system also allows a FanClub system manager to add and update flight information and benefits offered by FriendlyAir. Flight information includes flight number, day of the week and time of flight, and flight mileage. Benefit information includes benefit type, description of the benefit, and the mileage required to enjoy the benefit. In addition, the system manager can also add, delete, and update login accounts of FanClub service representatives, which include login IDs, passwords, and names of the service representatives. He can also update his own login password.

(a) Draw the use-case diagram of the FanClub software system. (15%)

(b) Draw the class diagram of the FanClub software system. The class diagram should identify the classes and their attributes, and the relationships between the classes. Omit class methods. (25%)

Notes:
- Whenever necessary, make your own reasonable assumptions about the system's requirements and briefly describe each assumption in 1 to 2 lines.
- For use cases, classes, and class relationships that are not apparent in the above description of the FanClub software system, briefly explain why they are needed. That is, give a 1 to 2-line explanation for each of such use cases, classes, and class relationships.

QUESTION 2 (30%)

The following is a scenario of the FanClub software system described in Question 1.

1. FanClub service representative enters membership card number.
2. FanClub system verifies that the member is valid.
3. Service representative enters member's benefit type.
4. System determines mileage required to enjoy the benefit.
5. System verifies that the member has enough unused mileage.
6. System creates new benefit claim record.
7. Service representative enters description of benefit.
8. System adds new benefit claim record to member's account.

(a) Draw a sequence diagram for the scenario. (15%)

(b) Draw a collaboration diagram for the scenario. (15%)

QUESTION 3 (15%)

Consider the following method specification:

```
public void registerModule(Student student, Module module)
    throws IllegalArgumentException
```

Description: Registers a student for a module.

Pre-conditions:
1. **student** is eligible for registering, and
2. **module** is offered in the semester, and
3. **student** has not registered for **module**, and
4. either **student** has not taken **module** or has failed the module in previous semesters.

Post-condition:
   student is registered for **module**.

(a) Identify the equivalence classes for the input (pre-) conditions and output (post-) conditions. (7%)

(b) Give a test case such that the method is expected to fail. Illustrate using an algorithm how you would write the test program for this test case. (8%)

QUESTION 4 (15%)

Multiple choice questions: 3 marks for each correct answer; −1 mark for each wrong answer.

1. It is difficult to apply black box testing technique to top-down integration because
   a. black box technique requires drivers,
   b. black box technique requires stubs,
   c. black box technique requires higher level modules to be tested first,
   d. black box technique requires lower level modules to be tested first,
   e. none of the above.

2. In a software system, the GUI should not be a data manager because
   a. it provides the services of an observer class,
   b. it creates the data manager,
   c. it is created by the data manager,
   d. all of the above,
   e. none of the above.

3. Two objects are loosely coupled if
   a. they don't talk to each other,
   b. they pass only simple data to each other,
   c. they do not modify each other's variables,
   d. all of the above,
   e. none of the above.

4. Suppose that method A calls another method B, and B throws an exception.
   a. A must catch the exception thrown by B.
   b. A can pass the exception to the method that calls A.
   c. A must rethrow the exception.
   d. All of the above.
   e. None of the above.

5. Information hiding means
   a. do not reveal any information to the client object,
   b. do not reveal information about actual implementation to the client object,
   c. do not reveal information about actual data to the client object,
   d. do not reveal information about method protocol to the client object,
   e. none of the above.

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