CSCC40 Midterm
Analysis and Design of Information Systems
Duration – 50 minutes

Examination Aids: No Aids allowed

Student #: |_|_|_|_|_|_|_|_|_|

Last Name:_____ **First Name:**_____

Do **not** turn this page until you have received the signal to start. In the meantime, please fill out the identification section above, and read the instructions below carefully.

This term test consists of 4 questions on 6 pages (including this one), printed on one side of the paper. When you receive the signal to start, please make sure that your copy of the examination is complete.

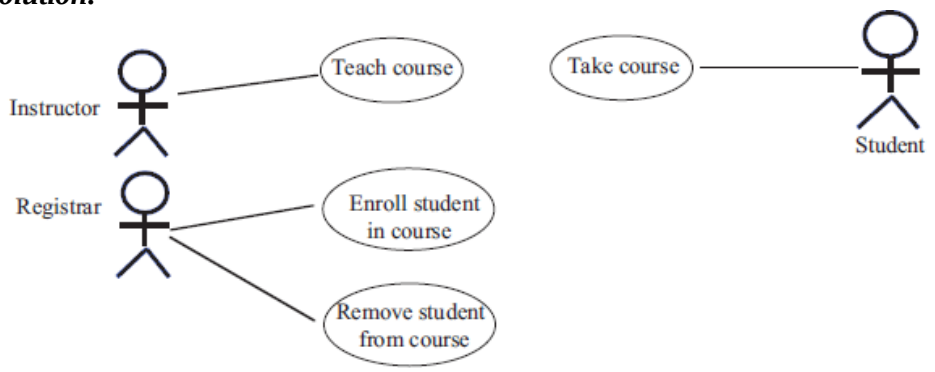
Answer each question directly on the examination paper, in the space provided, and use the reverse side of the pages for rough work. If you need more space for one of your solutions, use the reverse side of the page and indicate clearly the part of your work that should marked.

#1: Use Case	**_____/10**
#2: Class Diagram	**_____/20**
#3: State Diagram	**_____/10**
#4: Sequence Diagram	**_____/10**
	***Total*:_____/50**

Question 1: Use Case [*10 marks total*]

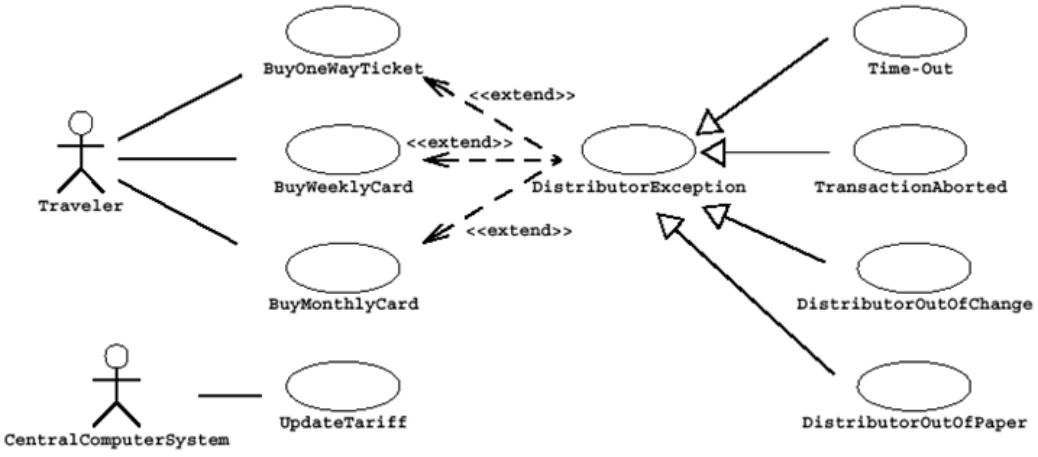
a) [5 marks] Draw a use case diagram for courses. In particular, assume that courses are taught by instructors, while registrars can enroll or remove students from a course. Students take a course, provided they are enrolled in it.

Solution:



b) [5 marks] Draw a use case diagram for a ticket distributor for a train system. The system includes two actors: a traveler, who purchases different types of tickets, and a central computer system, which maintains a reference database for the tariff. Use cases should include: BuyOneWayTicket, BuyWeeklyCard, BuyMonthlyCard, UpdateTariff. Also include the following exceptional cases: Time-Out (i.e., traveler took too long to insert the right amount), TransactionAborted (i.e., traveler selected the cancel button without completing the transaction), DistributorOutOfChange, and DistributorOutOfPaper.

Solution:



Marking:

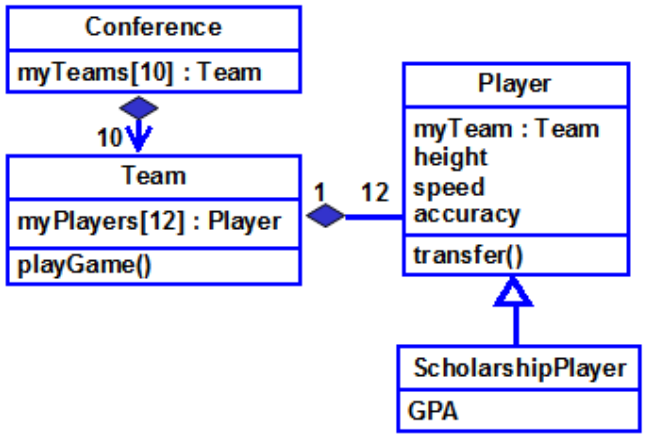
Since the use case names and actors were spelled out in the question, marking was based on identifying the relations between use cases.

Question 2: Class Diagram [*20 marks total*]

(a) [10 marks] Given the following problem description, draw a UML class diagram:

Design a simulation of a basketball conference. Each conference has 10 teams. Each team has 12 players. Each player has a specific height, speed, and accuracy. Players know which team they belong to. Some players are scholarship players. Scholarship players need to record their current grade-point average. Players may be transferred between teams. Teams play basketball games against other teams in the conference. The result of each game is determined using a function based on the height, strength, speed, and accuracy of the players on each team.

Solution:

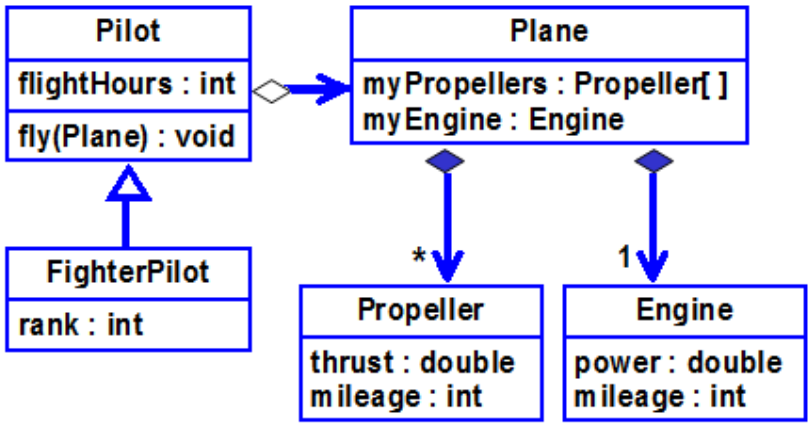


Marking:
Class identification → 2
Inheritance → 1
Cardinality → 1
Attributes enforcing cardinality constraints → 2
Composition relation → 2
Methods → 2

(b) [10 marks] Given the following Java code, draw a UML class diagram:

```
public class Propeller {
     public double thrust;
    public int mileage;
}

public class Engine {
     public double power;
     public int mileage;
}

public class Plane {
      public Propeller[] myPropellers;
      public Engine myEngine;

       public Plane( ){
         myPropeller = new Propeller[2];
         myPropeller[0] = new Propeller( );
         myPropeller[1] = new Propeller( );

         myEngine = new Engine( );
       }
}

public class Pilot {
      public int flightHours;
      public void fly(Plane p) {
          ...
      }
}

public class FighterPilot extends Pilot {
       public int rank;
}
```

Solution:

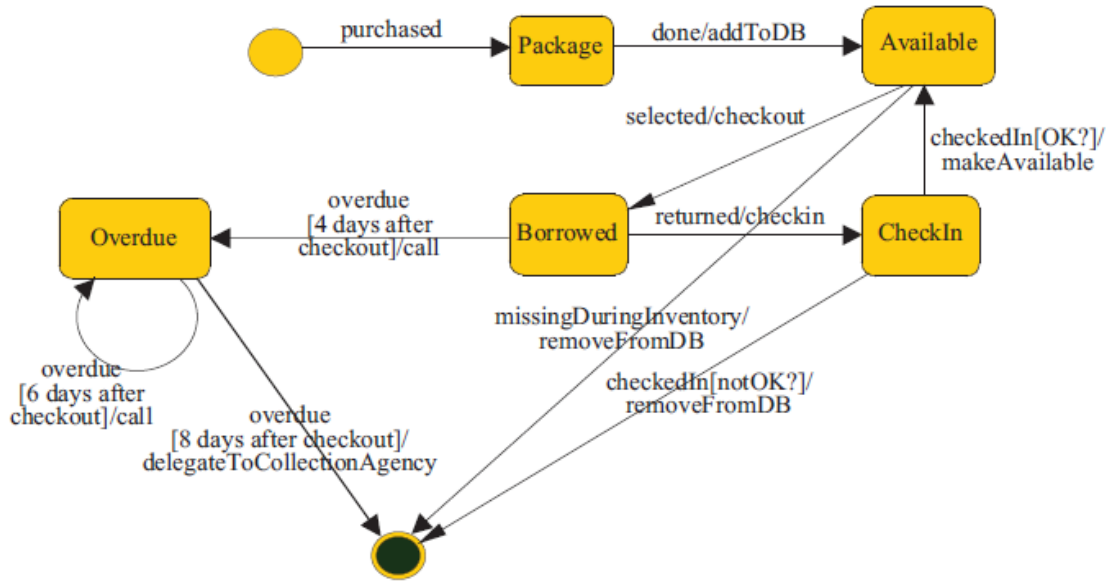


Marking:
Class identification → 2
Inheritance → 1/2
Cardinality → 1
Attributes enforcing cardinality constraints → 2
Composition relation → 2
Methods → 2
Pilot uses Plane → 1/2

Question 3: State Diagram [*10 marks total*]

Give a state diagram that describes the lifetime of a video tape in a video store. You can assume that a video tape is purchased, packaged properly (plastic case with identification information on the outside), put in the video store database, and is then put up for rental. Customers who choose to rent it, check it out and return it in 3 days. If a customer fails to return it, the store calls him/her the next day. The call is repeated a second time after 2 more days, and if the tape is not returned within 2 more days, the store delegates the matter to a collection agency and removes the video tape from its collection. If the tape is damaged on return, it is removed from the collection database also. Finally, if the tape is missing during the annual store inventory, it is removed from the collection database as well. Make sure to define events, conditions, actions for transitions in your diagram, where appropriate.

Solution:

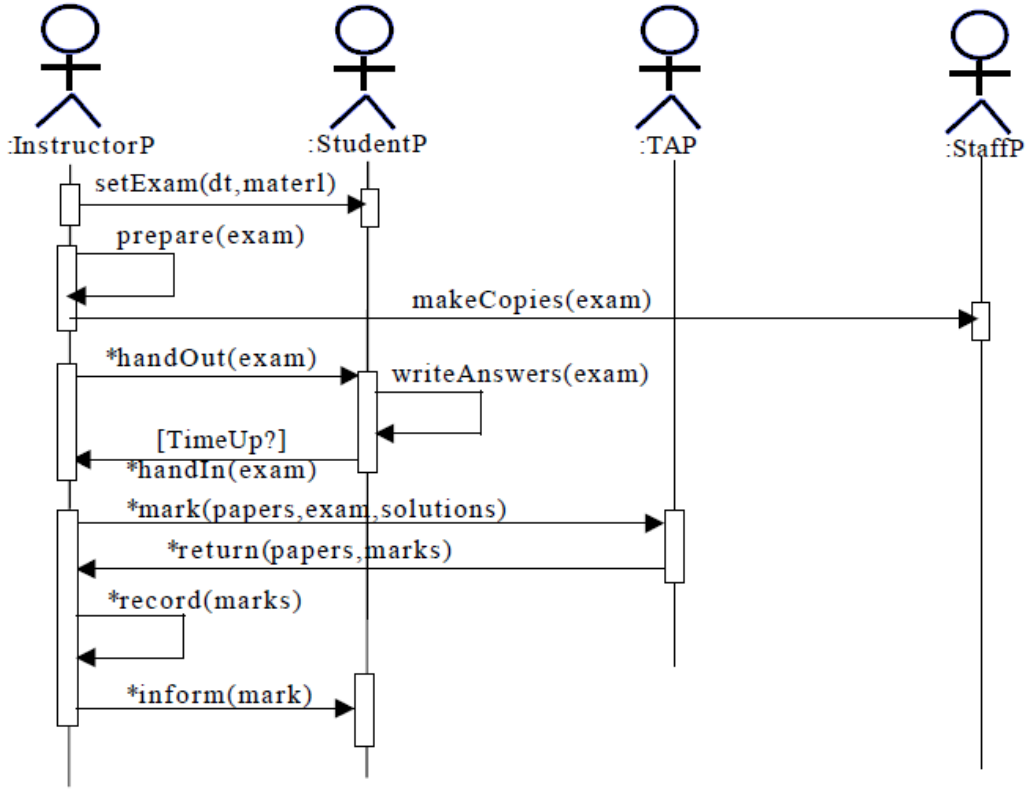


Marking:
State identification → 5
Relation identification → 5

Question 4: Sequence Diagram [*10 marks total*]

To give an exam, an instructor first notifies the students of the exam date and the material to be covered. She then prepares the exam paper (with sample solutions), gets it copied to produce enough copies for the class, and hands it out to students on the designated time and location. The students write their answers to exam questions and hand in their papers to the instructor. The instructor then gives the exam papers to the TAs, along with sample solutions to each question, and gets them to mark it. She then records all marks and returns the papers to the students. Draw a sequence diagram that represents this process. Make sure to show when each actor is participating in the process. Also, show the operation that is carried out during each interaction, and what its arguments are.

Solution:



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