CS2102, B10

Exam 2

Name:

Problem	Points	Score
1	30	
2	20	
3	20	
3	30	
	Total	

You have 50 minutes to complete the problems on the following pages. There should be sufficient space provided for your answers.

You do not need to show templates or an `Examples` class.

If a problem asks for test cases, you do not need to use any particular syntax (such as Tester or JUnit). You should include at least one description of a concrete input and its expected concrete output as part of your tests.

You do not need to write Javadoc or any other documentation.

1. (30 points) Consider the following interface and (partial) classes for banking accounts:

```
interface IAccount {
  // check whether user has entered correct pin number
  boolean checkPin(int enteredPin);
  // get the monthly fees due on this account
  double getFees ();
}

class Account implements IAccount {
  _________ int pin;
  _________ double balance;
  _________ boolean checkPin(int enteredPin) {
    return this.pin == enteredPin;
  }
  ...
}

class Checking extends Account {
  _________ double getFees() {
    ... (this.balance * .03) ...
  }
}
```

(a) (16 points) Fill in the blanks with appropriate access modifiers to (1) prevent other classes from accessing the pin and balance fields and (2) make the current code compile.

(b) (14 points) The bank is very concerned about protecting customers' balances. They insist that you make the balance field private. What changes would you make to the code shown to make it compile and run under this requirement? Assume that there are other `Account` subclasses with different `getFees` functions. Clearly indicate what existing code would have to change and what new code, if any, you have to add. You may answer this either with code or with prose.

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2. (20 points) You are developing software that helps people plan vacations. The software maintains a graph of cities, in which edges indicate direct transportation routes from one city to the other (as we did in class). For each city, the software maintains the city name, population, average temperature, and a list of available activities (ie, museums, skiing, hiking).

   You want to let people search your database of cities for destinations of interest. To do this, you provide a `search` method that takes a search criterion as a parameter. Here is the (partial) header for `search`:

   ```
   LinkedList<City> search(_____________ criteria);
   ```

   Knowing that we use objects to pass methods as arguments in Java, you set up the following class:

   ```
   class ChooseWarm __________________________ {

     boolean choose(City c) {
       return c.avgtmp > 80;
     }
   }
   ```

   Finally, given a list `CList` of `City`, you write the expression

   ```
     ... CList.search(new ChooseWarm()) ...
   ```

   Fill in the blanks with the code needed to make this example work. Your approach should be able to handle other search criteria on cities (such as which activities they have). If you introduce any new classes or interfaces while filling in the blanks, define those (in code) as well.

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3. (20 points) You are developing software for a social network that lets users create profiles, mark people as friends, and send messages to friends. Facebook is a good analogy. We have discussed several data structures this term: lists, trees, balanced binary search trees, heaps, hashtables, graphs, infinite trees, etc. For each of the following pieces of this social network, indicate which data structure you would use and why. Do not write code. Simply choose a data structure and defend your choice in a sentence or two of prose. Since multiple data structures could support each piece, a good answer will explain why your choice seems the best option.

   (a) The overall set of connections between people and their friends that form the heart of the network.

   (b) The messages sent to a user, which will be presented in order starting from the most recently received.

   (c) The mapping from usernames to users' profiles, on which lookups happen frequently.

   (d) A set of recommended "new friends" for a user based on the friends of their friends.

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4. (30 points) An airline needs to generate seat assignments from its reservations database. A seat assignment maps each seat to at most one passenger. Some passengers will have requested particular seats when making their reservations; a proper seat assignment should respect these requests (assume that no two passengers have requested the same seat). Passengers who have not requested a specific seat may be assigned to any seat.

   You have written a method `genSeatAssignment` with the following header:

   ```
     ISeatAssign genSeatAssignment(LinkedList<IPassenger> passengers,
                                   LinkedList<Seat> planeSeats)
   ```

   The first list contains the passengers on the flight. The second simply names the seats on the plane (with no information about passengers). The `IPassenger` and `ISeatAssign` interfaces have the following methods:

   ```
   interface IPassenger {            |      interface ISeatAssign{
     String getName();               |        Seat getAssignedSeat(IPassenger p);
     boolean hasSeatRequest();       |        void assignSeat(IPassenger p, Seat s)
     Seat getSeatRequest();          |      }
   }                                 |
   ```

   Describe how you will test that `genSeatAssignment` is returning proper seat assignments. You may describe your testing methodology in terms of general names for the inputs (ie, passenger list PL and seat list S), as long as you separately describe at least one concrete example of PL and S that you would use in testing. You do not need to reference the methods in the given interfaces (but may if you wish). If you need any setup or tear-down methods, describe them as well. Descriptions of methods (rather than code) will suffice.

(end of exam)