

Student ID _____ Student Name _____

Advanced Software Development DE Final Exam November 2, 2013

PRIVATE AND CONFIDENTIAL

1. Allotted exam duration is 2 hours.
2. Closed book/notes.
3. No personal items including electronic devices (cell phones, computers, calculators, PDAs).
4. Cell phones must be turned in to your proctor before beginning exam.
5. No additional papers are allowed. Sufficient blank paper is included in the exam packet.
6. Exams are copyrighted and may not be copied or transferred.
7. Restroom and other personal breaks are not permitted.
8. Total exam including questions and scratch paper must be returned to the proctor.

7 blank pages are provided for writing the solutions and/or scratch paper. All 7 pages must be handed in with the exam

BE VERY CAREFUL WITH THE GIVEN 2 HOURS AND USE YOUR TIME WISELY. THE ALLOTTED TIME IS GIVEN FOR EVERY QUESTION.

Write your name and student id at the top of this page.

Question 1 [50 points] {55 minutes}

We have to design a car rental application for one of our customers with the following requirements:

- The application keeps track of which customers (name, address) rents which car (licenceNumber, brand, type, price_per_day) on which days.
- The application keeps track of the list of credit cards that a customer may have
- The application keeps track of payments(amount, date)
- Car rentals can only be paid with credit card.
- Cars are categorized in categories (economy, business(standard, full size, specialty), minivan, suv, etc)
- Customers can become a member of the Rental Rewards Program. Customers receive rental points for every rental. The calculation of how many points a customer receives for a rental depends on the car type and how many days the car is rented.
- Whenever a customer becomes a member of this Rental Rewards Program, the customer gets a Regular Rental Rewards account. When the customer has more than 50.000 rental points, he or she gets an upgrade to a Medium Rental Rewards account. When the customer has more than 150.000 rental points, he or she gets an upgrade to an Ultimate Rental Rewards account.
- When you have a Medium Rental Rewards account your miles you would normally receive for a car rental will be doubled.
- When you have an Ultimate Rental Rewards account your miles you would normally receive for a car rental will be tripled.

a. [25 points] {25 minutes}

Draw the **UML class diagram** of the car rental application. **Make sure you add all necessary UML elements (interfaces, abstract classes, attributes, methods, multiplicity, etc) to communicate the important parts of your design. You only need to show the domain model of the car rental application, you do not need to worry about GUI classes, database classes, etc.**

Now another customer wants us to design a tool rental application with the following requirements:

- The application keeps track of which customers (name, address) rents which tools (toolnumber, toolname, price_per_day, price_per_week, price_per_month) on which days.
- A customer can rent out multiple tools in one rental.
- The application keeps track of payments(amount, date)
- Rentals can be paid with credit card, cash, check or with bank wire. If you pay by check, the application should store the name on the check, the check number and the bank name on the check. If you pay with bank wire, the application should store the name of the bank.

- Tools are categorized in categories (drilling tools, sawing tools, etc)
- Tool rentals can be insured but insurance is not required. If a tool rental is insured, then the application should keep track of the maximum amount that is insured and the price that has to be paid for the insurance.

Because this is our second rental application, we decide to make a rental framework.

The framework should support the following requirements:

- The framework keeps track of which customers (name, address) rents which rental-products on which days.
- A customer can rent out multiple rental-products in one rental.
- The application keeps track of payments (amount, date)
- Rentals can be paid with credit card, cash, check or bank wire. If you pay by check, the application should store the name on the check, the check number and the bank name on the check. If you pay with bank wire, the application should store the name of the bank.
- Rental-products are categorized in categories
- The framework supports all possible ways to specify the rental price: price per hour, price per half day, price per day, price per week, price per month, price per year, price per 2 weeks, etc.

b. [25 points] {30 minutes}

Draw the **UML class diagram** of the tool rental application using the framework.

So this class diagram should show the design of the framework, and the design of the tool rental application. In the class diagram, show clearly which classes are within the framework, and which classes are outside the framework (based on the requirements for the framework) . **Make sure you add all necessary UML elements (interfaces, abstract classes, attributes, methods, multiplicity, etc) to communicate the important parts of your design. You do not need to worry about GUI classes, database classes, etc.**

Question 2 [40 points] {55 minutes}

Design a hotel room reservation system with the following requirements:

- Customers can browse rooms
- Customers can search rooms
- Customers can reserve a room
- Customers can cancel a reservation
- Customers can change a reservation
- Customers can view their reservation
- Rooms are stored in the database
- Reservations are stored in the database
- Whenever a customer reserves a room, the system sends an email to the customer.
- It should be easy to change the technique of sending a message to the customer (SMS, WhatsApp message, etc)
- It should be easy to switch to any type of database, even non relational databases
- Whenever this application sends a message, we want to log that in a logfile
- It should be easy to log to any medium (comma separated file, database, XML file,...)
- We will be using the Spring framework to implement this application
- Every reservation has a unique reservation number
- For every reservation, the system records the start date, end date, total price, number of guest, room, customer first name, last name, email, address info and credit card info.
- For every room, the system records the room number, room type, room price, bed type, nr of beds
- Whenever the customer places a reservation, cancels a reservation or changes a reservation, we want to measure the time it takes for the actions to execute, and we want to log the result in a logfile.
- All messages we send to the customer are also logged in a logfile.

Draw the **UML class diagram** of the hotel reservation application. **Make sure you add all necessary UML elements (interfaces, abstract classes, attributes, methods, multiplicity, etc) to communicate the important parts of your design.** Make use of all the best practices we learned in this course. Show very clearly where you use Dependency Injection (DI), AOP or certain design patterns.

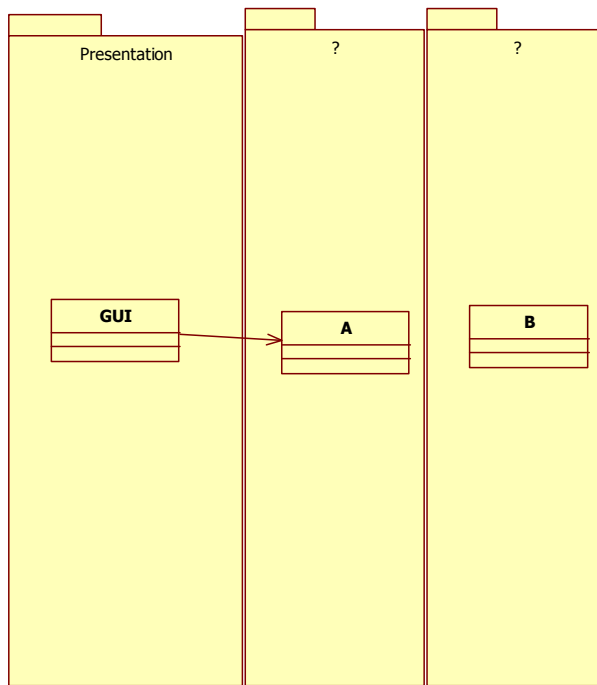
To show where to use DI, use the following notation:



To show where to use AOP, use the following notation:



In your UML class diagram show the different layers of your design, and place the classes in the particular layers, similar as the solution of the last shopping application lab. For the GUI you can use just one GUI class that represents the complete GUI implementation. So your class diagram should look like the example below (see next page).



Question 3 [5 points] {10 minutes}

Describe how the **factory** pattern relates to one or more of the SCI principles you know. Your answer should be about half a page, but should not exceed one page (handwritten). The number of points you get for this questions depend on how well you explain the relationship between the **factory** pattern and the principles of SCI.