Student ID__________________Student Name____________________________________

Advanced Software Development DE Final Exam March 24, 2012

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 ALLOTED TIME IS GIVEN FOR EVERY QUESTION.

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

Question 1 [40 points] {50 minutes}

Design a general contact framework. This framework should contain the following functionality

- You should be able to **add** and **remove** contacts
- For every contact, the framework should store the first name, last name, email and phone number
- The frameworks can provide a list of the last 20 add or remove contact actions the user has done. We should be able to undo and/or redo any of these.
- Using the framework, it should be very easy to execute different functionality whenever we add or remove a contact. For example, the application that uses the framework might want to send a welcome SMS for every contact we add, and a goodbye SMS to every contact we remove. Or the application writes to a logfile whenever we add or remove a contact.

Now we want to use this contact framework to implement a contact application. This contact application has the following additional requirements:

- The application that uses the framework sends a welcome email to every contact we add, and a goodbye email to every contact we remove.

a. Draw in **one class diagram** the design of the contact application using the framework. So this class diagram should show the design of the framework, and the design of the contact application. **In the class diagram, show clearly which classes are within the framework, and which classes are outside the framework. Make sure you add all necessary UML elements (attributes, methods, multiplicity, etc) to communicate the important parts of your design.**
b. Draw a complete sequence diagram that shows the scenario where the user adds a new contact.

Question 2 [50 points] {60 minutes}

We need to design a rental framework which can be used to write rental applications such as a DVD rental application or a car rental application. The framework has the following requirements:

- We should be able to add new rentals, delete rentals and search rentals.
- For every rental we need to store the name, phone, email, street, city and zip code of the customer. We also need to keep track of the start date of the rental, the maximum duration of the rental and the end date of the rental.
- The framework should also support the functionality reserve products that you can rent. For every reservation you make, you need to keep track of the date you reserved it.
- The framework should also allow for categorizing the products that you can rent. So you can have for example a category “new releases” for a DVD rental application, and this category contains sub-categories like “drama” of “romance”
- The framework should also support different algorithms to compute the rental fee.
- The framework should support functionality for handling the events when customers don’t return their products on time. Every rental has a start date and a maximum duration. If the maximum duration has passed, the rental application should be able to handle this by sending an email, sending an SMS, writing to a log file, etc. The framework should have the functionality that an event is generated when the maximum duration has passed, and the application class should handle the desired action for the particular application.
- Rental shops often have more than one copy of the same product. A DVD rental shop might have 4 copies of one DVD title. A car rental might have 4 Ford Mustang cars. The rental framework should support this.

Now we want to use this rental framework to implement a DVD rental application. This DVD rental application has the following additional requirements:

- If the maximum duration of the DVD rental has passed, the rental application should send an email.
- We have 2 different formulas for computing the rental fee, one for new releases and one for all the others (not new releases)
- The DVD rental application should support international addresses for customers, so for every customer, we should also store the country (besides the street, city and zip).
- Every DVD copy has a unique DVD number
- For a DVD we want to store the title, release date and language.

Draw in **one class diagram** the design of the DVD rental application using the framework. So this class diagram should show the design of the framework, and the design of the DVD rental application. **In the class diagram, show clearly which classes are within the framework, and which classes are outside the framework.**
Make sure you add all necessary UML elements (attributes, methods, multiplicity, etc) to communicate the important parts of your design.
Make sure we can use the framework also for other domains, like the rental of cars or tools.

Question 3 [10 points] {10 minutes}

Describe how the Singleton 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).
Write clearly – if I cannot read it, I cannot give you any points for it.