Advanced Software Development DE

Practice Midterm Exam

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.**

5 blank pages are provided for writing the solutions and/or scratch paper. All 5 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 [10 points] {10 minutes}

Below you find a list of design problems. Give the name of the pattern that can solve the given design problem.

Design problem	Pattern name
Suppose you need to design an XML parser that reads in a XML file, that builds the internal representation of this XML file into objects such that you can access the content of this XML.	
We need to be able to record all actions done by the user so we can replay these actions later	
We need to design a UI framework that supports different layouts. The framework has 3 different build-in layouts, but programmers should be able to write and use their own layout. An example of a layout would be to place all UI controls in a horizontal way. Another layout would be to place all UI controls in a grid of 3 by 3	
We need to implement event handling for UI controls like buttons, check boxes, etc.	
Suppose you need to design a alarm system that allows you to add different alarming devices such as a flashing light, an alarming horn, etc. It should be easy to add new alarming devices.	
Suppose you need to design a payment system that can handle different payment cards like visa, mastercard, debit card, and also many foreign bank cards. It should be easy to add new payment cards.	

Question 2 [60 points] {80 minutes}

Suppose you have to design the controller software for an automatic gate. The gate controller application has the following requirements:
We have a remote control with only one button.
If we press the button on the remote control, and the gate is open, then the gate should be closed.
If we press the button on the remote control, and the gate is closed, then the gate should be opened.
If we press the button on the remote control, and the gate is opening, then the gate should be closed.
If we press the button on the remote control, and the gate is closing, then the gate should be opened.

We also have a gate sensor that signals our application if the gate is completely closed or opened.
Because we want to make or automatic gate as safe as possible, we also have an audio buzzer that makes noise when the gate is opening or closing. When the gate is completely open or closed, the buzzer is idle.

Your first design might look as follows:
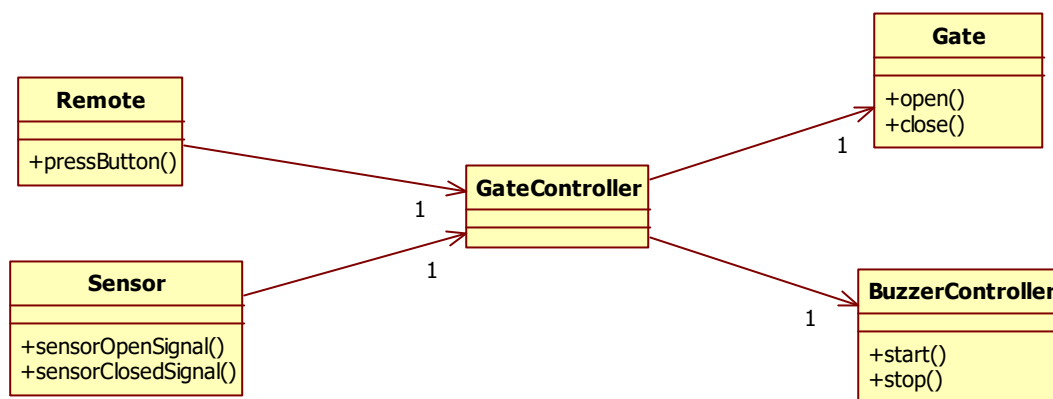
a. [10 points] Now you receive a new requirement from marketing, that the remote control now gets 3 buttons. One button to open and close the door, and an undo and a redo button.
   Draw the class diagram of your new design. Make sure that your diagram shows all the important UML parts, and that it implements the appropriate design principles we studied in this course

b. [20 points] Draw the sequence diagram that shows clearly how your design works. The initial state of the gate is closed, so assume the gate is closed when the sequence diagram starts. Show the sequence diagram of the following user actions:
   1. The user presses the button that opens the door
   2. When the door is completely open, the user presses the button again to close the door
   3. When the door is completely closed, the user presses the undo button.

c. [10 points] Now you receive another new requirement from marketing. When the gate is busy with opening or closing, and you press the button on the remote, then the gate should stop moving and stand completely still. The buzzer should also go idle if the gate stands completely still. In this state, when you press the button again, it should continue with the action it was doing, either opening or closing the gate. You notice now that the implementation of the GateController becomes ugly with a lot of conditional code. Draw the class diagram that shows how you would redesign the class diagram given in part a. Make sure that the undo and redo actions still work fine. Make sure that your diagram shows all the important UML parts, and that it implements the appropriate design principles we studied in this course

d. [20 points] Draw the sequence diagram that shows clearly how your new design works. The initial state of the gate is closed, so assume the gate is closed when the sequence diagram starts. Show the sequence diagram of the following user actions:
     1. The user presses the button that opens the door
     2. When the door is half open, the user presses the button again so that the door will stand still.
     3. The user presses the button again

Question 3 [25 points] {30 minutes}

Draw the class diagram of a product catalog application with the following requirements:

- You can add and delete different product categories (like electronics, books, cars)
- For every category we store its name.
- A product category can have subcategories (and subcategories can also have subcategories, etc.)
- You can add and delete products in/from categories
- For every product we store its productnumber, name and price.
- You can add customer reviews to products
- You can view all reviews for a certain product
- A review consists of a description and a certain integer number between 1 and 5 that shows how much stars a product can get from a customer. 1 star means that the customer was not very happy with the product and 5 stars means the customer was very happy with the product.
- All the products in this product catalog have a certain owner
- Because these products change from owner very quickly, we can see the history of all previous owners of a certain product
- All data is stored in a database.

Your design should implement the appropriate design principles we studied in the course.