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### Object Oriented Modeling and Design Midterm Exam

#### QUESTION 1 (40 Points): Use Case, Analysis

In the library of a university there are three different types of media (book, journal and CD) to barrow. Each item in the library has a unique number.

To barrow an item the user must login to the system by entering her/his user id and password.

Then the user enters the number of the item. If the user has the right to barrow this item the return date appears on the screen; otherwise a warning message is shown. After the user barrowed all items she/he exits the system. A user can barrow a limited number of items (for example only 4). There are also different rules for different media. For example; a user can barrow only 3 books, and 2 CDs. Journals cannot be barrowed.

- Write the use case for the described “barrow” operation.
- Construct the domain (analysis) model of the system and draw it as a UML class diagram.
- Write the operation contract for the operation where the user enters the number of item to be barrowed into the system.

#### QUESTION 2 (40 Points): Design

A class X, to fulfill its responsibility  $r()$ , gets service from (sends message  $m()$  to) class A. There is a possibility, that in the future class A can be replaced by class B, which has a different interface. Class A will be completely removed from the system and class B will be used instead of it. It is not possible to use more than one class at the same time to get the service.

- Design this part of the system according to design principles and patterns. Draw the class diagram and mention the principles and patterns used in this solution.
- Is the polymorphism necessary for this solution? Explain shortly.
- Assume that Class A will not be removed from the system and class X will get the same service sometimes from class A and sometimes from B. In the future a new class C can also be added to the system. Design this part of the system, draw the class diagram and mention the principles and patterns used in this solution.

#### QUESTION 3 (20 Points): Don't talk to strangers

- What is the problem we may encounter if we ignore the law of Demeter (Don't Talk to Strangers Principle)?
- Define three small classes in C++ to show the case of talking to strangers. Fix this code to solve the problem.

*Start to write your solution at the back of this page.*