

Lab3 Solutions

Problem 1

In the code folder for this lab there is a package `lesson3.labs.prob1` containing two classes, `Person` and `PersonWithJob`. In each class, the `equals` method has been overridden. Run the `main` method in the `PersonWithJob` class. In the `main` method, two instances of `Person` have been compared to determine if they are equal. The comparison is done in two different ways. One way leads to a “false”, the other to a “true.” Explain why this has happened. Then provide a solution by replacing inheritance with composition.

Explanation:

`PersonWithJob` is a `Person`, but the opposite is not true. Therefore, we cannot compare a ‘superclass’ with a ‘derived/ child’ class.

Code Available In:

Attached in an eclipse file with the name of ‘MPP-Lab3’ inside the packages ‘prob1’.

Problem 2

Design a solution to the problem given below, and then implement in code. A Main class has been provided in the startup code that hard-codes values and attempts to test your code. You may wish to modify the Main class so that it matches your implementation of the other classes – it is provided as a convenience. The main method should calculate the income for the hardcoded values. (Note that the problem in this case is different from the one given in Lab 1.)

Problem 2: Problem Statement

A landlord owns multiple buildings, each building has multiple apartments. Each apartment has a rent associated with it. Each building generates profit which is the sum of all the apartment rents minus the building maintenance costs. Write a program that will calculate the landlord's monthly total profits.

Code Available In:

Attached in an eclipse file with the name of 'MPP-Lab3' inside the packages 'prob2'.

Problem 3

- A. UML classes Circle and Cylinder are given below, pictured in an inheritance relationship. Write the code for Circle and Cylinder in Java, making use of the inheritance relationship. Does it make sense to use inheritance here? Explain.

Explanation: No. Mathematically, even though a cylinder is a circle with height equals to 0, this implementation can break the code if a circle instance receives a height greater than 0.

- B. Redo the design using composition and write the resulting code in Java.

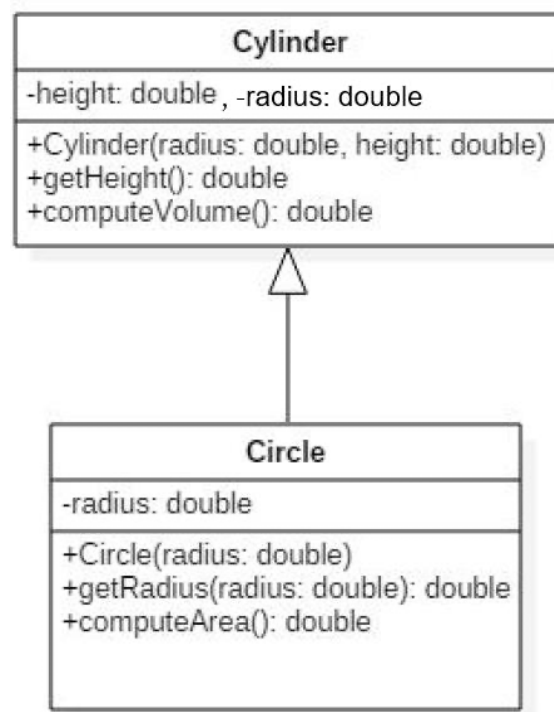


Figure1: Class Diagram for Circle and Cylinder with Inheritance Implementation

Code Available In:

Attached in an eclipse file with the name of 'MPP-Lab3' inside the packages 'prob3A' and 'prob3B'.

Problem 4

In Lab 1 a properties management system was introduced. In that lab, you specified classes and some attributes for those classes. In this exercise, think of a way to design further using inheritance and include associations (with multiplicities) and some operations for you classes. Then translate your diagram into Java code. Both an Admin and Driver class have been provided in your code folder. The Driver class creates some instances of the different properties and passes these into the Admin method `computeTotalRent`; this method performs a correct computation, but the implementation proceeds by checking the types of the different rental properties. Refactor the implementation of `computeTotalRent` so that the inheritance you have introduced is used, together with polymorphism. Below is provided the problem statement and a solution for the Lab 1 exercise.

Problem Description:

A landlord owns several types of properties: houses, condominiums, and trailers.

A house has an address and a lot size. Rent for a house is computed by

$$\text{rent} = 0.1 * \text{lot size}$$

A condominium has an address and a certain number of floors (1 floor, 2 floors, or 3 floors). Rent for a condominium is computed by

$$\text{rent} = 400 * \text{number of floors}$$

A trailer belongs to a particular trailer park (specified by the trailer park address).

The rent for a trailer is always \$500.

The property management software is required to have an Admin module that supports various functions. One of these functions is to compute total rent for all the properties registered in the system. Another function is to list all properties in the system that are in a specified city.



Solution:

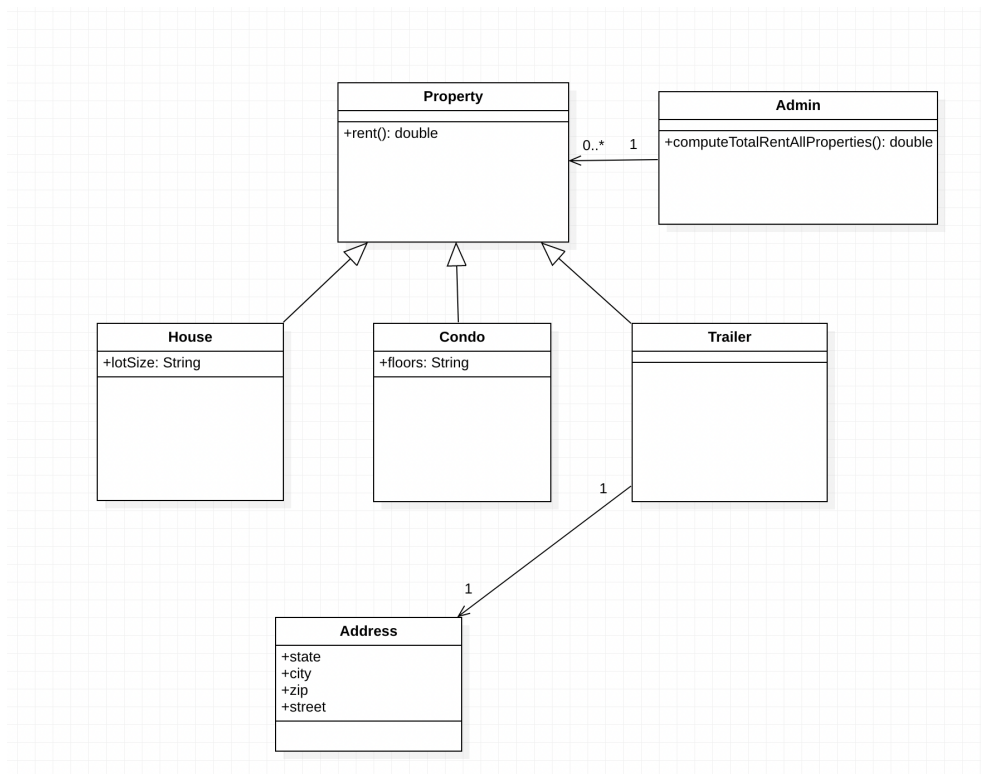


Figure2: Class Diagram for Property Management System

Code Available In:

Attached in an eclipse file with the name of 'MPP-Lab3' inside the packages 'prob4'.