
OOC-2 LAB 05 HANDOUT AND TASKS

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1 LSP

The Liskov Substitution Principle (LSP) is one of the five SOLID principles of object-oriented programming, introduced by Barbara Liskov. The principle states that

What is wanted here is something like the following substitution property: If for each object O_1 of type S there is an object O_2 of type T such that for all programs P defined in terms of T, the behavior of P is unchanged when O_1 is substituted for O_2 then S is a subtype of T.

In other words, SUBTYPES MUST BE SUBSTITUTABLE FOR THEIR BASE TYPES. LSP supports OCP as the latent violation of LSP is a violation of OCP.

Example

```
1 class Rectangle
2 {
3     public:
4         virtual void SetWidth(double w) {itsWidth=w;}
5         virtual void SetHeight(double h) {itsHeight=h;}
6         double GetHeight() const {return itsHeight;}
7         double GetWidth() const {return itsWidth;}
8     private:
9         Point itsTopLeft
10        double itsHeight;
11        double itsWidth;
12 };
13 class Square : public Rectangle
14 {
15     public:
16         virtual void SetWidth(double w);
17         virtual void SetHeight(double h);
18 };
19 void Square::SetWidth(double w)
20 {
21     Rectangle::SetWidth(w);
22     Rectangle::SetHeight(w);
```

```
23 }
24 void Square::SetHeight(double h)
25 {
26     Rectangle::SetHeight(h);
27     Rectangle::SetWidth(h);
28 }
29
30 // somewhere else code
31 void g(Rectangle& r)
32 {
33     r.SetWidth(5);
34     r.SetHeight(4);
35     if((r.Area() == 20){
36         Console.WriteLine(" rectangle " + r.Area());
37     }
38     else{
39         Console.WriteLine("Exception");
40     }
41 }
```

Listing 1: C sharp code

2 TASK

Scenario

Marks 15

You are asked to build a Shape drawer application. A shape can be a circle, rectangle, or square. A circle can be represented using a point (x,y) and a radius. A rectangle can be represented by a point (x,y) that denotes the top left point of the rectangle, a length, and a width. Similarly, a square can be represented using a top left point, and a side length. Each shape area can be calculated using the known formula. Moreover, each shape is drawable. A canvas can receive a list of drawable shapes, and draw all of those.

1. Write C# or Java code that does not follow OCP.

2. Write 3 test cases to check the correctness of your program.
3. Refactor your code so that it follows OCP.

Scenario**Marks 15**

You are asked to build a movie rental system. Your collection has different genres of movies like Horror, Romantic, Thriller, and Other. Each movie can be recognized by title, genre, release date, and duration. Any horror movie has 20%, romantic movie has 30%, and thriller movie has 15% discounts on the base price. Other movies do not have any discounts. Moreover, if a thriller movie is more than 5 years old additional 10% discount will be applicable. The base price of a movie is decided by the rental service.

1. Write C# or Java code that does not follow OCP.
2. Write 3 test cases to check the correctness of your program.
3. Refactor your code so that it follows OCP.

2.1 LSP Task

Scenario

Marks 10 + 5

You are asked to build an account management system. There are different types of accounts. Each of the accounts has an account number, balance, and account holder name and signature. Each of the accounts can perform some basic operations like withdrawals, deposits, balance checks, etc. Currently, the system supports two types of accounts, namely saving accounts and current accounts. The minimum balance for the saving account is 1000, whereas the current account is 500. The maximum withdrawn amount for saving is 15000 whereas the current account is 20000.

Change request 1: For saving accounts, an account holder gets 10% interest yearly, and current accounts have 8% interest.

Change request 1: A new type of account Islamic account needs to be added to the system which has a minimum balance limitation of 200 and a maximum withdrawal amount is 10000. However, it does not provide any interest.

1. Write C# or Java code that does not follow LSP by throwing an unsupported exception (which is a custom exception if you know how to use them otherwise a built-in exception).
2. Write 10 test cases to check the correctness of your program. Focus on balance, withdrawal, and interest for all accounts.