Car Configuration Application

Reflection Questions on Unit 1

You should review the following questions to make sure you understand the outcomes from Unit 1 and potentially document lessons learned for submission (with final unit of Car Configuration Application). You do not submit these questions for grading.

Q1 - What is the relationship between containment and encapsulation (as applied in this project) when building components?

Q2 - What are some ways to analyze data (presented in requirements) to design Objects?

Q3 - What strategies can be used to design core classes so you can design for future requirements and at the same time make classes reusable, extensible and easily modifiable?

Q4 - What are good conventions for making a Java class readable?

Q5 - What are the advantages and disadvantages of reading data from sources such as text files or databases in a single pass and not use intermediary buffering?

Q6 - What is the advantage of using Serialization? When issues occur when using Serialization with Inner classes?

Q7 - Can you describe situations where to use the following object relationships - encapsulation, association, containment, inheritance and polymorphism?

Q8 - How can you design objects so each one is self-contained and independent?

Requirements

Part A

In this assignment you will continue to build a Car Configuration Application

I would like you to expand your proof of concept – so we will build API's for car configuration classes using interfaces and abstract classes and also add a custom exception handler to enhance your design.

For expanding proof of concept please consider the following requirements:

We will expand your existing design with these options:

- Define a set of methods in an interface (as API) that can be used to exercise the functionality of the existing class set.
- Create an exception handler so it handles at least 5 exceptions
- Enhance your design and code to create any abstract classes so your code is extensible and reusable.

Your Deliverable:

Design and code classes for these requirements and write a driver program to exercise your API and test the exception handler. Test your code adequately.

Concepts you will need to know.

- Object Theory
- Exception Handling
- Abstract Classes
- Interfaces

Plan of Attack - Part A

Refactoring

All class names should be declared as nouns. In the last unit we created Automotive that needs to be renamed to Automobile. Please complete this step before approaching this unit. Please do this with extreme care using IDE's refactor feature.

Step 1 – Writing API – Design and Construction

1. Analyze what you are being asked to do.
    a. You are being asked to build API for car configuration classes.
    b. Develop a custom exception handling mechanism to make your module more reliable.
2. From the information provided in the lab description following are the considerations for developing API.
    a. You will definitely need to use Interfaces.
    b. You have Model package (a component) that have Automobile class. Each Automobile class contains an instance of OptionSet and respective Options.
    c. In first unit you were asked to make the methods in OptionSet and Option class protected. Only methods of Automobile class are set as public.
    d. We are now trying to provide a set of methods that act as a Programming Interfaces for accessing functionality in Model package.
    e. Before we decide on how to create and implement the methods, let's read through and understand the meaning of a Java Interface. Please review the article at - http://docs.oracle.com/javase/tutorial/java/concepts/interface.html to learn the importance of Interfaces.
    f. Now let's decide on methods that should be exposed in the Interface.

        1. public void BuildAuto(String filename);

        //Given a text file name a method called BuildAuto can be written to build an instance of Automobile. This method does not have to return the Auto instance.

        2. public void printAuto(String Modelname);

        //This function searches and prints the properties of a given Automodel.

        3. public void updateOptionSetName(String Modelname, String OptionSetname, String newName);

        //This function searches the Model for a given OptionSet and sets the name of OptionSet to newName.

        4. public void updateOptionPrice(String Modelname, String Optionname,

String Option, float newprice);

//This function searches the Model for a given OptionSet and Option name, and sets the price to newPrice.

For our implementation we will implement these four methods.

g. Few considerations for structuring the code:
   i. It is not important for us to expose the Automobile instance. We can create an Automobile instance and provide all the required functionality in the chosen API in last step.
   ii. So how do we organize the code so we can encapsulate Automobile.
      1. Create a new package called Adapter.
      2. Add two interfaces in package called Adapter:
         a. One called CreateAuto and add BuildAuto and printAuto methods in it.
         b. Another one called UpdateAuto and add updateOptionSetName and updateOptionPrice in it.
      3. Add a new abstract class called proxyAutomobile in Adapter package. This class will contain all the implementation of any method declared in the interface.

```
package Adapter;
import Model.*;
public abstract class proxyAutomobile {
     private Automobile a1;
}
```

         This class contains an instance variable of type Automobile. Variable a1 can be used for handling all operations on Automobile as needed by the interfaces.
      4. So this raises a question – if we are defining all methods declared in interfaces in the abstract class proxyAutomobile then why is proxyAutomobile not implementing the interfaces. We will use inheritance for this purpose. We want proxyAutomobile to be a "hidden" containing all the functionality and expose an empty class for usage with Interfaces. In other words, we will add a new class called BuildAuto in Adapter package that will have no lines of code but will always look like this.

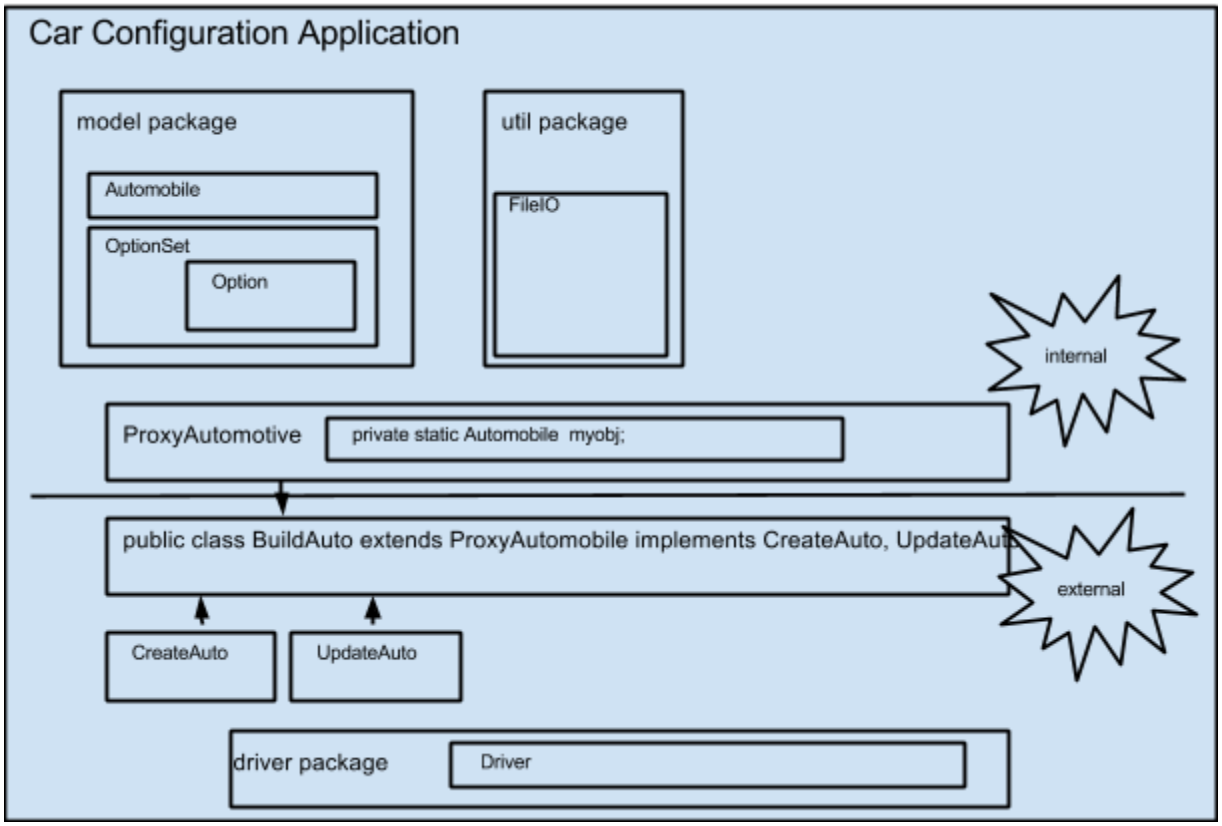
```
package Adapter;

public class BuildAuto
     extends proxyAutomobile implements createAuto,
updateAuto{

}
```

So whenever a new interface has to be added you can simply update BuildAuto declaration and write all methods in Abstract class called proxyAutomobile.

In a nutshell we have encapsulated access to Automobile instance from the API and also hidden the code (artificially) in the abstract class.



5. Next write a driver to test each of the methods.
    a. Are you able to create and print an Auto instance through CreateAuto interface?
    b. Are you able to update one of OptionSet's name or Option Price for the Auto instance created in previous step.
    c. Chances are that you will not be able to update as the object in proxyAutomobile is not declared as a "static" Object. In other words when you create an instance for BuildAuto (child of proxyAutomobile) a new Automobile is created. This requires variable a1 to be static so it can be shared between objects.

Step 2 - Defensive mechanisms to make software Self-Healing

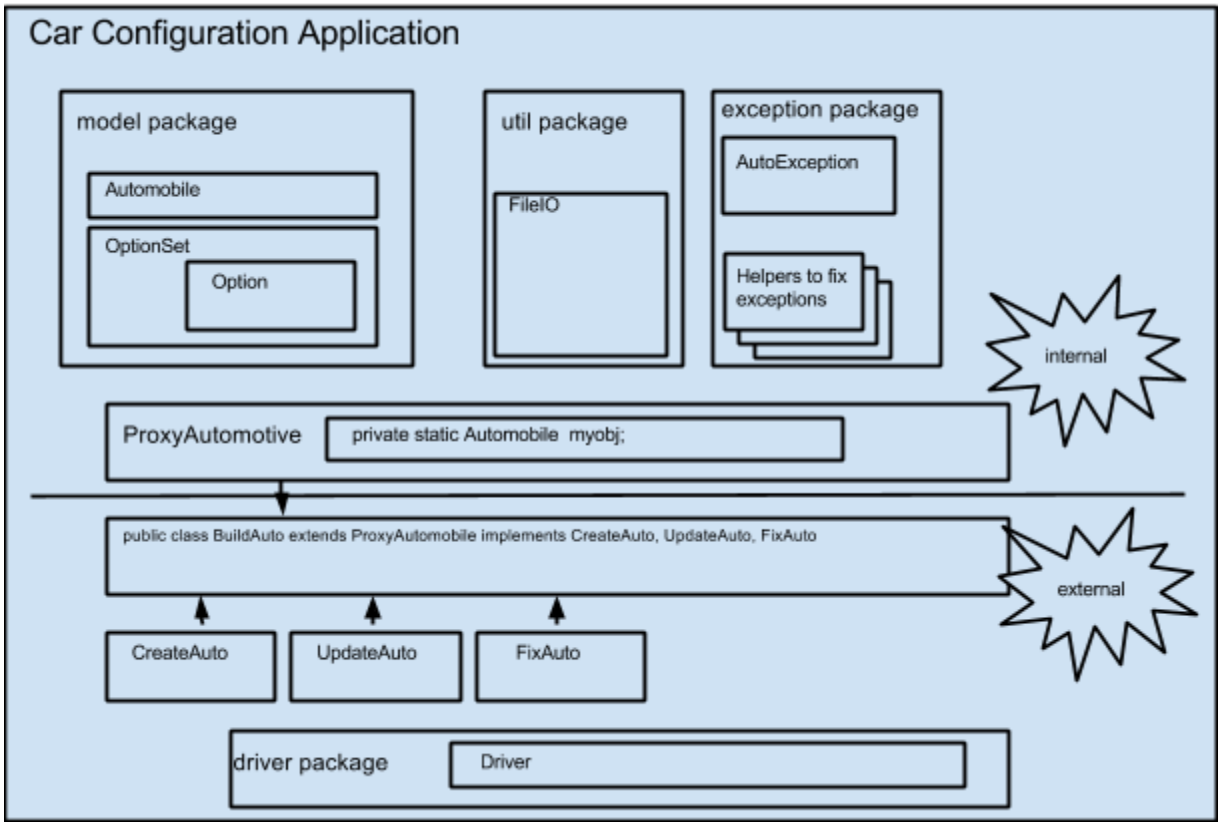
Our next step to add a custom exception handler to deal with issues in runtime.

For doing this, you will first need to review the custom exception handling classes provided. After you have learned how to write a custom exception class, throw exception and how to catch and fix, you can implement it in this project.

Think of five possible exceptions to fix - Here are some possible examples:

1. Missing price for Automobile in Text file.
2. Missing OptionSet data (or part of it)
3. Missing option data
4. Missing filename or wrong filename.

Your Exception class at a minimum should handle and fix at least one exception.



AutoException should have the following features:

1. Ability to track error no and error message.
2. Contain an enumeration of all possible error number and messages that can be used when AutoException is instantiated.
3. Ability to log AutoException with timestamps into a log file. (You do not need to implement any complex logging mechanism - a simple one for this project will suffice.)
4. Write helper classes to delegate fixes for each method. For e.g. if exception number 1 to 100 is assigned to model package, you might author a clas called Fix1to100 as a helper class for AutoException that contains

fix methods for exceptions that are raised in model package.

5. AutoException should have the following implementation of fix method that can be used for fixing any exception in entire application

```
public void fix(int errno)
{
      Fix1to100 f1 = new Fix1to100();
      switch(errno)
      {
            case 1: f1.fix1(errno);break;
            …
      }
}
```

6. Next, make the fix method accessible through FixAuto interface.

Requirements and Approach for Part B

Unit 2 - Part B

Your first step is to re-implement our current system, with the same functionality, but with code that's better designed to handle multiple models.

Technical Requirement – Set of Models(Automobile) should be saved using LinkedHashMap. Set of OptionSet in each Model and respective Options can be saved in an ArrayList.

In addition, both Automobile and OptionSet will need some methods for keeping track of which options a user has chosen. To try and keep straight which methods are for defining options, and which are for choosing options, I've put Choice in the name of the new methods related to tracking user choices.

Here's a UML class diagram for additional things in Automobile:

```
Automobile
- make: String
- model: String
- optionSets: ArrayList
- choice: Option
+ getMake(): String
+ setMake(make: String): void
+ getModel(): String
+ setModel(model: String): void
+ getOptionChoice(setName: String): String
+ getOptionChoicePrice(setName: String): int
+ setOptionChoice(setName: String, optionName: String): void
+ getTotalPrice(): int
```

The method setOptionChoice() is for choosing a particular option in an option set. E.g.,

```
setOptionChoice("transmission", "standard");
```

would choose the standard transmission option. After the above choice is set,

getOptionChoice("transmission") would return "standard" and
getOptionChoicePrice("transmission") would return -815.

To make it easy to define the Automobile methods for tracking option choices, add the following methods to OptionSet:

```
OptionSet
...
```

...

+ getOptionChoice(): Option

+ setOptionChoice(optionName: String): void
setOptionChoice(), given the name of an option, would save that choice inside the option set. getOptionChoice() would return the option chosen, if any, otherwise it should return null.

To test this new Automobile class, write a driver program to read your text input file, populate an instance of Automobile class and print the OptionSet's and their respective options.

Your application should work just as it did before, but will be much closer to being able to handle multiple models. (This means that you can still select an optionset with their respective options and calculate the car price, given user's selection.)

Working with LinkedHashMap –
Note that to access elements in LinkedHashMap you will need to associate an Iterator and then use it to find the elements in LinkedHashMap.

Submitting your work

Pl. review your work against this checklist before submission:

1. Program Specifications / Correctness
    a. No errors, program always works correctly and meets the specification(s).
    b. The code could be reused as a whole or each routine could be reused.
    c. Custom Exception Handler has been implemented with usage of five minimum exceptions.
    d. Abstract Classes constructs utilized to add extensibility
    e. Interfaces utilized to expose Model's (Auto, OptionSet and Option) functionality is meaningful(means the methods in interface are well thought out/useful in context of application).
    f. Collection - LinkedHashMap is implemented for group of Automobile class. OptionSet and Option implement ArrayList
    g. Automobile class has way to track user selection (through creation of Option choice variable and related functionality).
2. Readability
    a. No errors, code is clean, understandable, and well-organized.
    b. Code has been packaged and authored based on Java Coding Standards.
    c. Text input file is readable and easy to follow.
3. Documentation
    a. The documentation is well written and clearly explains what the code is accomplishing and how.
    b. Class Diagram is provided.
4. Code Efficiency
    a. No errors, code uses the best approach in every case. The code is extremely efficient without sacrificing readability and understanding.
    b. Ability to correct exceptions is added in exception handling class. Ability to log exceptions is added.