Online Market Place Application

Assignment #6: Report

Implementation of Database Access Layer Pattern and Assignment Overviews

Course: CSCI 50700 - Object-Oriented Design and Programming

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Introduction:

All the assignments of this course aim at building a distributed Online Market Place application using the proper use of design principles and patterns. In these series of assignments, a distributed application is developed which can run on the provided six machines and uses MYSQL database for persistent data storage.

Assignment Overviews

Assignment #1 Overview:

In this assignment, the focus was on building a skeleton for the Online Market Place application. Analysis of requirement specification and creating domain model from that is done in this assignment. Working on this first assignment introduced me to what a software design pattern is and how to build a software following these object-oriented design patterns. Constructing a software following design patterns helps to improve software quality along with providing reliability. Adding to this, I have learnt to design a design model using the given requirements and turning this model into classes. Making use of MVC pattern helps a software to separate graphical interface and logic. Java RMI helps a software to work in a distributed manner hence providing reliable communication for the components server and client. Building a clean skeleton framework is the first step and this helps to further progress constructing other software patterns on top of this framework. The feedback I have received for this assignment is that I have violated the separation of concerns. I have placed the application logic in the controller which violates the main aim of MVC pattern. In this assignment I have just used a single controller on the server side, but an additional layer is required on the client side for improving my design. So, in the next assignment I have added a client controller and I have improved my server-side model to handle all the application logic.

Assignment #2 Overview:

In this assignment, the focus was on building upon the skeleton provided in assignment-1 using the patterns – Front Controller, Command and Abstract Factory patterns. The main challenge I have felt while implementing these patterns is where to incorporate the specific pattern functionality in the application. While implementing the front-controller pattern, I have understood that each user view should be dispatched through the front-controller pattern. The main difficulty I faced was understanding the concept of point of entry to the application as I thought that the views should only be dispatched through the front-controller. But that was solved by using a Client entry view which is used a generic view for login and registration. I have used Abstract Factory pattern for creating Admin and Customer Factories which are used in the dispatcher for calling their respective views. Identifying the usage of command pattern was easier as the requests and actions from users can be treated as commands. The main take away from this assignment was learning the use of combination of patterns in an application.

Assignment #3 Overview:

In this assignment, the focus was on building upon the existing framework provided by previous assignments using Authorization, Proxy and reflection pattern. The main use of authorization pattern is to restrict the unauthorized user access of functions in a distributed application. In this application, there are two roles customer and admin, using the combination of these pattern I have implemented the role-based access functionality. I have also learnt a new technology, Java annotations which can be used to build a role-based access application. On top of role-based access, I have also learnt the use of proxy and reflection pattern which supplement the functionality of role-based access. I have understood the usage of session object and its creation in a role-based access environment.

Assignment #4 Overview:

In this assignment, the focus was on exploring the concurrency in Java and demonstration of concurrency in this application. I have understood how the RMI multi-threading works over multiple clients and how Java RMI concurrency works. In the assignment, I have used the database MYSQL for persistent storage and Machine ***in-csci-rrpc01.cs.iupui.edu - 10.234.136.55*** is used as the Server. In this assignment I have observed how the application works with and without synchronization.

Assignment #5 Overview:

In this assignment, the focus was on Java Synchronization and its patterns. I have understood how synchronization and various design patterns will help a distributed application to function in a thread-safe manner along with providing concurrent features. Also implemented full functionalities in the market application based on given requirements. This assignment mostly helped me to understand how Java has provided in-built constructs like synchronized function or blocks which provide synchronization support for the application.

Database Access Layer Pattern:

The main motivation for Database Access Layer Pattern is to provide a loosely coupled and stable relationship between the object-oriented model and the relational database schema. Most of the object-oriented systems uses relational database system for persistent storage of data. The constructs for accessing and storage in both are not similar. For example, In Java concepts like collections are used and in relational databases SQL Queries are used. In both the cases data mapping can lead to complexities. So, A Database layer introduced between the Object-Oriented model and the database can provide decoupling between them by encapsulating the mapping between the database tables and the Objects. Using this Layer, the changes to application logic does not affect the database layer and vice-versa. This layer is responsible for mapping data between the format required by database tables and the Java data structures.

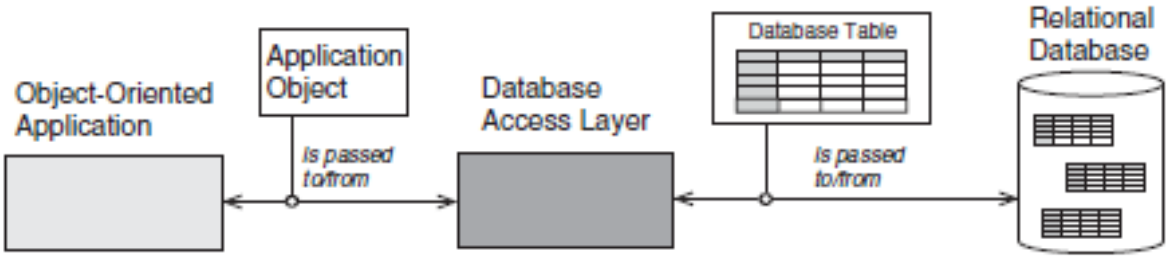


Fig1: Database Access Layer Application [2]

For implementing this pattern, I have used a DBConnection class as the database access layer in the assignment. The application logic for the Online Market Place application is maintained in the MarketPlaceModel class and all the database access logic is implemented in the DBConnection class.

Database Design:

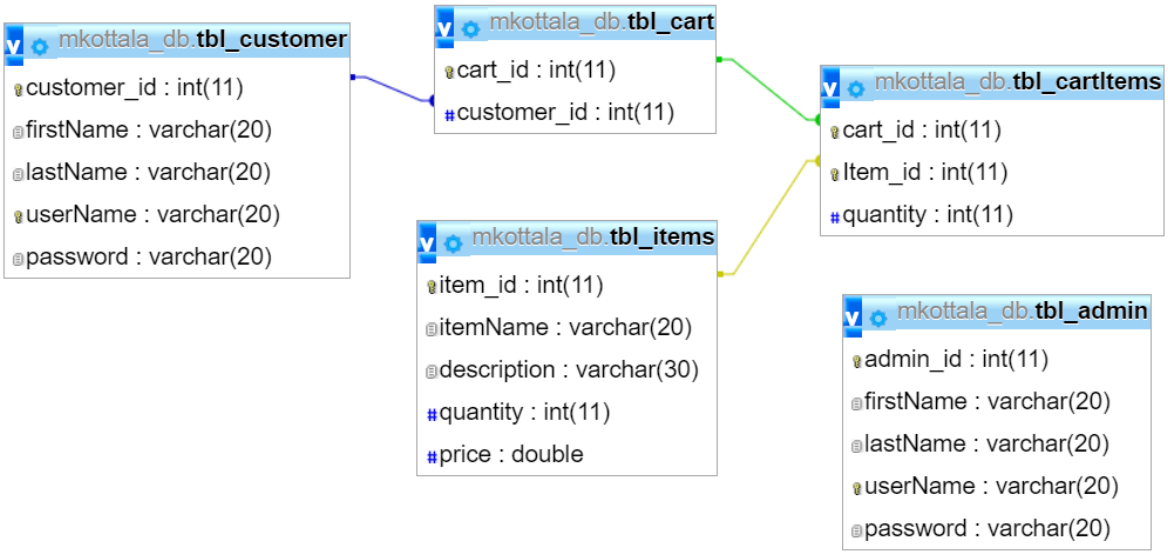


Fig2: Database design for MarketPlace Application

Domain Model:

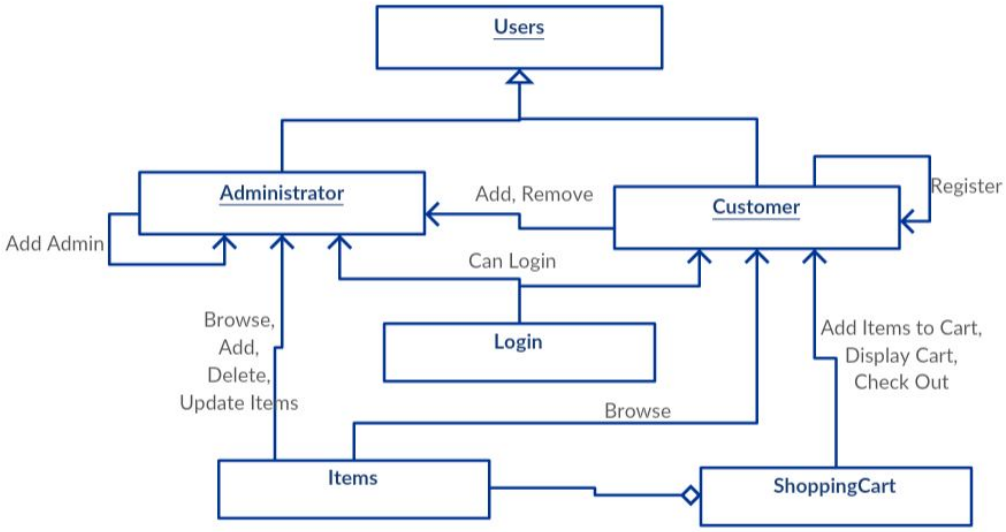


Fig3: Domain Model for Market Place Application

Class Diagram[3]:

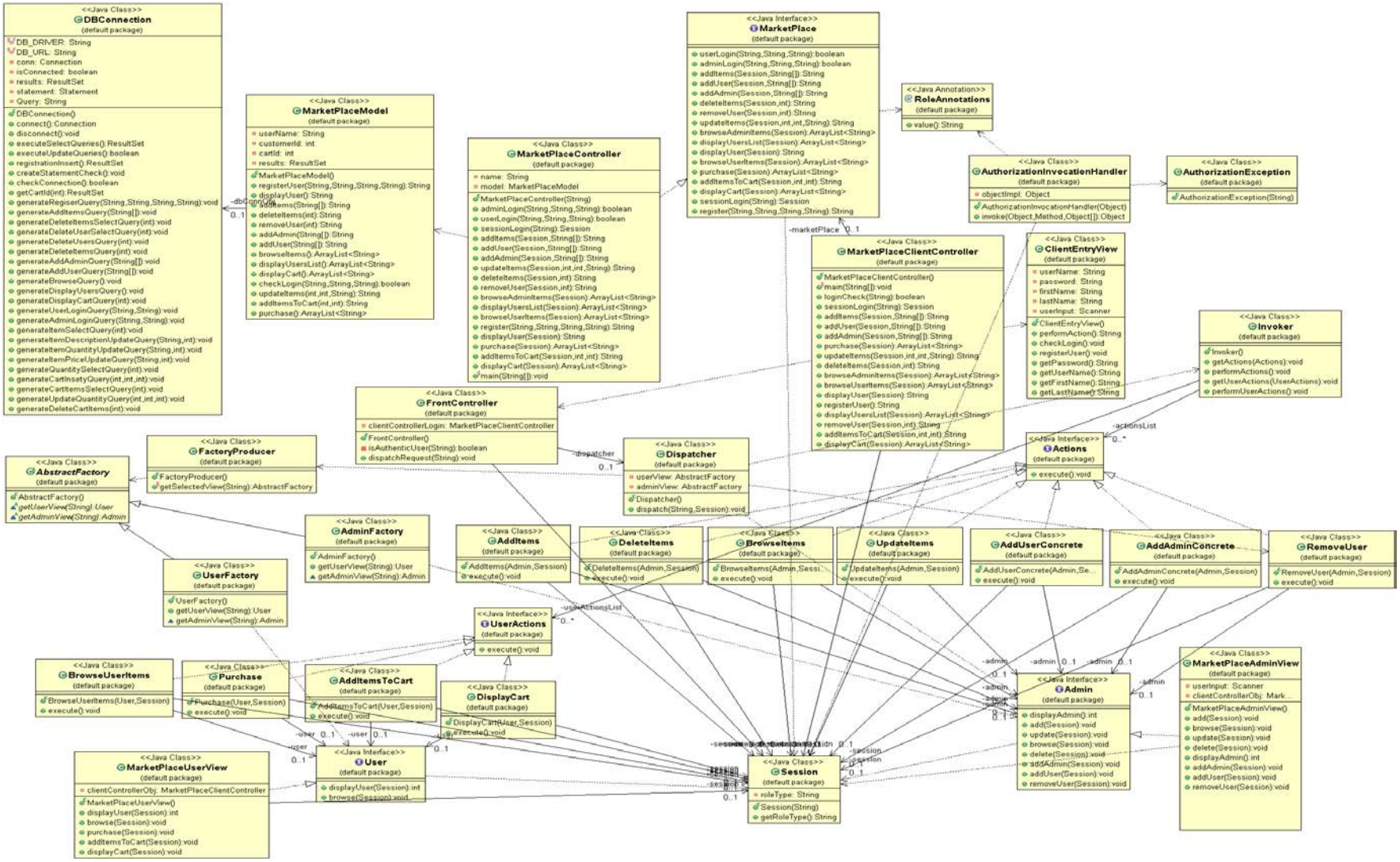


Fig 4: Class Diagram for Market Place Application

Sample runs:

1. Starting the RMI registry and Running the server application on Machine - **10.234.136.55**

```
[mkottala@in-csci-rrpc01 Assignment6]$ rmiregistry 2526&
[1] 10094
[mkottala@in-csci-rrpc01 Assignment6]$ sh MakeControllerServer.sh
Creating a Server Connection!
MarketPlaceModel: binding it to name: //10.234.136.55:2526/MarketPlaceServer
Market Place Server is Ready!
```

2. Running the Client application on any of the machines - 10.234.136.56, 10.234.136.57, 10.234.136.58, 10.234.136.59 and 10.234.136.60

```
[mkottala@tesla Assignment6]$ sh MakeClientView.sh
Enter Action as either 1, 2 or 3:
1. User
2. Admin
3. Customer Registration
```

3. Registration:

The details entered in the Customer Registration is added to customer table and the customer view is displayed.

```
Enter Action as either 1, 2 or 3:
1. User
2. Admin
3. Customer Registration
3
Enter first Name:
David
Enter last Name:
Warner
Enter username:
warner
Enter Password:
warner
Registering User
user Registration Successful and displaying User View
User authentication is successful.
Displaying User Profile
User Profile Display from Server
Enter Action
1.Browse Items
2.Checkout (Purchase cart Items)
3.Add Item to Cart
4.Display cart
```

4. Customer Functions:

   Customer has the following functions –

   - Browse Items

```
Displaying User Profile
User Profile Display from Server
Enter Action
1.Browse Items
2.Checkout (Purchase cart Items)
3.Add Item to Cart
4.Display cart
1
************************************ ITEMS DISPLAYED HERE ****************************************

Item Id  Item Name             Description                Quantity       Price
7        Tables                Tables                     18             50.0
8        Speaker               Bose Speaker               2              55.0
9        Laptop                Dell Laptop                1              50.0
10       Clock                 Clock                      12             24.0
11       Light Stand           Mainstays                  2              75.0
14       Shutters              Mainstays                  10             25.0
15       PenDrive              Sandisk                    48             15.0
19       cooker                Prestige                   40             59.0
************************************************************************************************************
```

   - Add Items to Cart

```
************************************ ADD ITEMS TO CART ************************************
Enter the item Id to add item to cart:
10
Enter item Quantity:
6
Added item Successfully
************************************************************************************************************
```

   - Display Cart

```
****************************************** DISPLAYING CART ************************
Cart Items displayed here :
CartId   ItemId   Quantity
36        10       6
36        19       5
************************************************************************************************************
```

   - Check-Out

```
2
************************************ CHECK OUT ************************************
Item Id : 10 Successfully Purchased
Item Id : 19 Successfully Purchased
************************************************************************************************************
```

5. Admin Functionalities:

   Admin has the following functions –

   - Browse Items

```
2
View : Admin
Enter username:
manju
Enter Password:
manju
Login Checking
Admin authentication is successful.
Displaying Admin Profile
For exit enter anything other than 1,2,3,4,5,6,7
1.Add Items
2.Delete Items
3.Update Items
4.Browse Items
5.Add Admin
6.Add Customer
7.Remove Customer
4
****************************************** ITEMS DISPLAYED HERE ************************************
ITEM ID  ITEM NAME              DESCRIPTION                 QUANTITY        PRICE
7        Tables                 Tables                      18              50.0
8        Speaker                Bose Speaker                2               55.0
9        Laptop                 Dell Laptop                 1               50.0
10       Clock                  Clock                       6               24.0
11       Light Stand            Mainstays                   2               75.0
14       Shutters               Mainstays                   10              25.0
15       PenDrive               Sandisk                     48              15.0
19       cooker                 Prestige                    35              59.0
************************************************************************************************************
```

   - Add Items

```
1
****************************************** ADDING ITEMS ********************************
Enter Item Name:
Television
Enter Item Description:
Samsung
Enter Item Price:
550
Enter Item Quantity:
6
item has been added
************************************************************************************************************
```

- Update Items

```
3
*****************************************************************************************************
ITEM ID  ITEM NAME              DESCRIPTION                    QUANTITY        PRICE
7        Tables                 Tables                         18              50.0
8        Speaker                Bose Speaker                   2               55.0
9        Laptop                 Dell Laptop                    20              50.0
10       Clock                  Clock                          6               24.0
11       Light Stand            Mainstays                      2               75.0
14       Shutters               Mainstays                      10              25.0
15       PenDrive               Sandisk                        48              60.0
19       cooker                 Prestige                       35              59.0
22       Television             Samsung                        6               550.0
Enter Item Id from above list:
22
*****************************************************************************************************
Enter update action 1, 2 or 3
1. Update item Description
2. Update item Price
3. Update item Quantity
1
Enter Update Value :
Sony
Updated Item Description
*****************************************************************************************************
```

```
3
*****************************************************************************************************
ITEM ID  ITEM NAME              DESCRIPTION                    QUANTITY        PRICE
7        Tables                 Tables                         18              50.0
8        Speaker                Bose Speaker                   2               55.0
9        Laptop                 Dell Laptop                    20              50.0
10       Clock                  Clock                          6               24.0
11       Light Stand            Mainstays                      2               75.0
14       Shutters               Mainstays                      10              25.0
15       PenDrive               Sandisk                        48              60.0
19       cooker                 Prestige                       35              59.0
22       Television             Sony                           6               550.0
Enter Item Id from above list:
15
*****************************************************************************************************
Enter update action 1, 2 or 3
1. Update item Description
2. Update item Price
3. Update item Quantity
2
Enter Update Value :
15
Updated Item Price
*****************************************************************************************************
```

```
**********************************************************************************************
ITEM ID  ITEM NAME              DESCRIPTION                    QUANTITY        PRICE
7        Tables                 Tables                         18              50.0
8        Speaker                Bose Speaker                   2               55.0
9        Laptop                 Dell Laptop                    20              50.0
10       Clock                  Clock                          6               24.0
11       Light Stand            Mainstays                      2               75.0
14       Shutters               Mainstays                      10              25.0
15       PenDrive               Sandisk                        48              15.0
19       cooker                 Prestige                       35              59.0
22       Television             Sony                           6               550.0
Enter Item Id from above list:
8
**********************************************************************************************
Enter update action 1, 2 or 3
1. Update item Description
2. Update item Price
3. Update item Quantity
3
Enter Update Value :
16
Updated Item Quantity
**********************************************************************************************
```

- Delete Items

```
2
********************************************** DELETE ITEMS ********************************
Item Id  Item Name              Description                    Quantity        Price
7        Tables                 Tables                         18              50.0
8        Speaker                Bose Speaker                   16              55.0
9        Laptop                 Dell Laptop                    20              50.0
10       Clock                  Clock                          6               24.0
11       Light Stand            Mainstays                      2               75.0
14       Shutters               Mainstays                      10              25.0
15       PenDrive               Sandisk                        48              15.0
19       cooker                 Prestige                       35              59.0
22       Television             Sony                           6               550.0
Enter Item Id from above list:
19
Deletion of Item successful
**********************************************************************************************
```

- Add Admin

```
5
********************************************** ADDING ADMIN ********************************
Adding Admin
Enter First Name:
Hannah
Enter Last Name:
Blake
Enter username:
hannah
Enter password:
hannah
Admin has been added
**********************************************************************************************
```

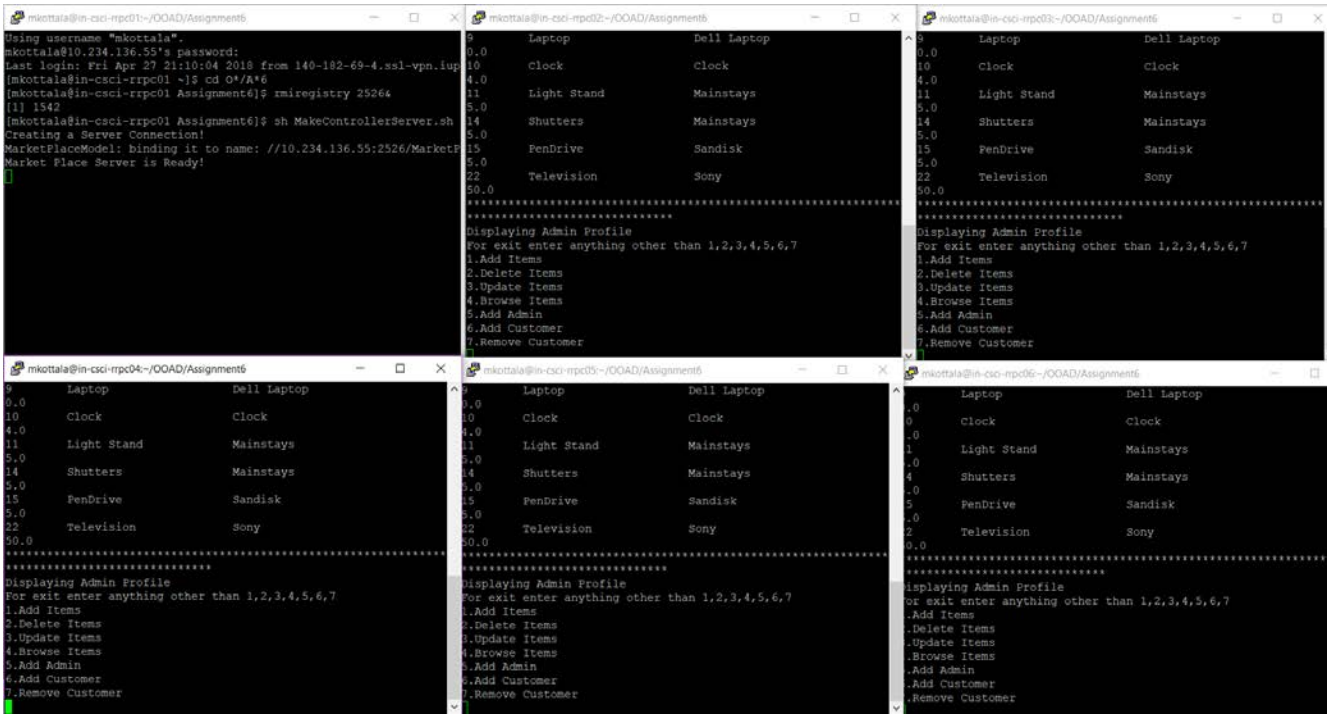
- Add Customer

```
********************************************** ADD USER ************************************
Adding User
Enter First Name:
Priya
Enter Last Name:
Shield
Enter username:
priya
Enter password:
priya
Customer has been added
********************************************************************************************
```

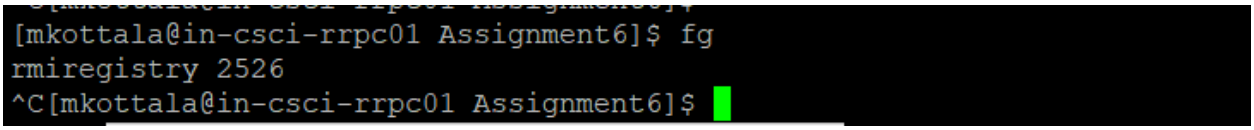
- Remove Customer

```
********************************************** REMOVE USER *********************************
Id        User Name
2         mkottala
25        rahul
26        blair
27        tessa
29        stone
30        swapna
31        barma
34        srikar
35        ramesh
37        harshi
40        saiti
42        blake
43        leslie
44        grace
45        warner
46        priya
Enter Customer Id to delete from above list:
43
Remove User successful
********************************************************************************************
```

6. Concurrency demonstration in application:



7. Terminating RMI registry:



Conclusion:

I had an object-oriented design patterns as part of the coursework in under-graduation and got acquainted with several design patterns theoretically. But current course was well designed in such a way that, I have learnt many design patterns both theoretically and their respective real-time implementation. I thoroughly liked learning every design pattern and put it into action along with the other patterns. Not only design patterns, I have also learnt how a design pattern works in the perspective of Java language.

We have used Java as the programming language, I would agree that Java is one of the most powerful and popular Object-oriented languages, but while exploring the design patterns I learnt that Java has in-built constructs for some design pattern implementations e.g., synchronization. I think languages like C++ will be more useful for demonstrating the use of some patterns than Java. The communication style that we have used is RMI, I would be more helpful in practical applications if we have explored other communication styles in the assignment.

I would have liked to include GUI in my application, so that it would have been a completely interactive distributed application. I felt that it wouldn't have been an overwork to implement UI if I had implemented starting from the first assignment. After seeing the presentations from my classmates, I understood there can be many ways in designing/implementing the application and the design choices we make from the beginning will play a crucial role in building the application. In first assignment, I felt clueless about the design patterns, but now I can say that I have gained knowledge on most of the design patterns and I would always consider the use of appropriate patterns while designing an application. I would say that this assignment is one of the best projects that I had worked on in my graduate study.

References:

[1] class slides

[2] Schmidt, D. C., Stal, M., Rohnert, H., & Buschmann, F. (2013). *Pattern-Oriented Software Architecture, Patterns for Concurrent and Networked Objects* (Vol. 2). John Wiley & Sons.

[3] https://dzone.com/articles/uml2-class-diagram-java