Lab 2

	Student Name	Student CSUSM ID	Contribution percentage
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Grading Rubrics (for instructor only):

Criteria	1. Beginning	2. Developing	3. Proficient	4. Exemplary
Modeling	0-14	15-19	20-24	25-30
Program: functionality ***correctness***	0-9	10-14	15-19	20
Program: functionality ***Behavior Testing***	0-9	10-14	15-19	20
Program: quality -> ***Readability***	0-2	3-5	6-9	10
Program: quality -> ***Modularity***	0-2	3-5	6-9	10
Program: quality -> ***Simplicity***	0-2	3-5	6-9	10
Total Grade (100)				

Problems:

The ABC Company typically uses an object of the SortingUtility class to sort products. A product has at least three attributes: ID, name and price. All are accessible through their corresponding get() method but the ID is fixed once set.

The SortingUtility class implements two private sorting algorithms, bubbleSort and quickSort, each of which takes the list of products and returns an ordered list of products. The SortingUtility class also has a public method List<Product> sort(List<Product> items, int sortingApproach), which simply calls the specified sorting approach (i.e., bubbleSort or quickSort) to return a list of sorted products to its client.

The SortingUtility currently does not log the list of sorted products before returning it to the client. Now the ABC Company would like to have an improved sorting service that can log (for this lab, simply printing to the display console) the list of sorted products before returning it to the client. To implement this improved service you cannot change **the existing** SortingUtility **class for compatible reason**. Moreover, the returned products from bubbleSort should be logged (printed) with ID followed by name and price, whereas the returned products from the quicksort should be logged (printed) with name first followed by ID and price.

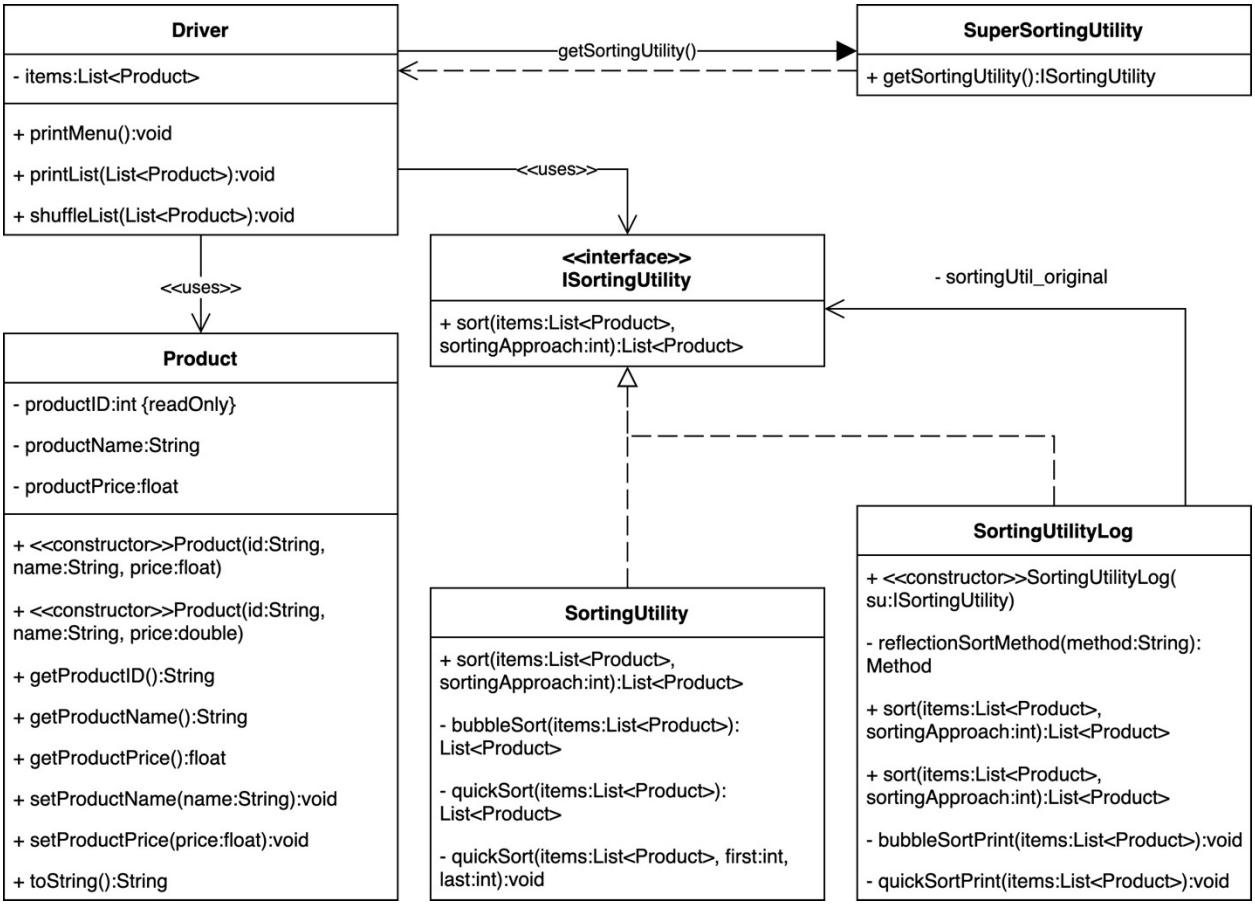
(30 pts) What design pattern can be used? Document your pattern-based design in UML class diagram, ensure attributes, methods, visibility, arguments and relationships are correctly included.

(70 pts) Implement your pattern-based design in Java. Implement two test scenarios: one using quicksort to sort a list of products such as books, bags, and buttons, another using bubblesort to sort the same list of products.

Solution:

- First, remember to zip the src folder of your project and submit the zip file to the ungraded assignment named "Lab2CodeSubmission". One submission from each team.
- Paste a screenshot of a run of your program here.
- Also paste all you source code here.
- Save this report in PDF, then **each student** needs to submit the pdf report to the graded assignment named "Lab2ReportSubmission".

Using Proxy with Super Helper Class



Screen Shots

```
-------------------------------------------
Menu:              [0] Exit
[1] Sort BubleSort  [3] Shuffle & Print List
[2] Sort QuickSort  [4] Print List
-------------------------------------------
Selection: 4
** Default print using System.out.println(Prodct::toString())
5715451 - Vintage Canvas Shoulder Laptop Bag - $49.99
7989021 - Bentgo Bag - Insulated Lunch Box Bag - $9.99
9379410 - Polyhedral 7-Die Scarab Dice Set - $9.41
9249825 - Deluxe Reusable Grocery Bag w/ Bottle Sleeves - $25.95
4729011 - Coleman Tent Kit - $12.97
7400234 - Flashlight Holster - $7.85
3958646 - Premium Bookends for Shelves - $17.73
8050622 - Dungeon & Dragons: Dungeon Master's Guide 4E - $35.1
5169007 - Lies My Teacher Told Me: History Textbook - $18.08
8277821 - Vintage Travel Casual Daypack - $26.74
6245816 - Batman Vol. 5: Zero Year - Dark City - $11.13
1165822 - Lamentations of the Flame Princess - $17.08

-------------------------------------------
Menu:              [0] Exit
[1] Sort BubleSort  [3] Shuffle & Print List
[2] Sort QuickSort  [4] Print List
-------------------------------------------
Selection: 1

Bubble Sort Called
Product ID  Product Name                                  Price
----------  ------------                                  -----
1165822     Lamentations of the Flame Princess            $ 17.08
3958646     Premium Bookends for Shelves                  $ 17.73
4729011     Coleman Tent Kit                              $ 12.97
5169007     Lies My Teacher Told Me: History Textbook     $ 18.08
5715451     Vintage Canvas Shoulder Laptop Bag            $ 49.99
6245816     Batman Vol. 5: Zero Year - Dark City          $ 11.13
7400234     Flashlight Holster                            $  7.85
7989021     Bentgo Bag - Insulated Lunch Box Bag          $  9.99
8050622     Dungeon & Dragons: Dungeon Master's Guide 4E  $ 35.10
8277821     Vintage Travel Casual Daypack                 $ 26.74
9249825     Deluxe Reusable Grocery Bag w/ Bottle Sleeves $ 25.95
9379410     Polyhedral 7-Die Scarab Dice Set              $  9.41
```

```
-------------------------------------------
Menu:              [0] Exit
[1] Sort BubleSort  [3] Shuffle & Print List
[2] Sort QuickSort  [4] Print List
-------------------------------------------
Selection: 3

** Shuffle List
** Default print using System.out.println(Prodct::toString())
8050622 - Dungeon & Dragons: Dungeon Master's Guide 4E - $35.1
9249825 - Deluxe Reusable Grocery Bag w/ Bottle Sleeves - $25.95
6245816 - Batman Vol. 5: Zero Year - Dark City - $11.13
7400234 - Flashlight Holster - $7.85
1165822 - Lamentations of the Flame Princess - $17.08
3958646 - Premium Bookends for Shelves - $17.73
4729011 - Coleman Tent Kit - $12.97
5715451 - Vintage Canvas Shoulder Laptop Bag - $49.99
7989021 - Bentgo Bag - Insulated Lunch Box Bag - $9.99
8277821 - Vintage Travel Casual Daypack - $26.74
5169007 - Lies My Teacher Told Me: History Textbook - $18.08
9379410 - Polyhedral 7-Die Scarab Dice Set - $9.41

-------------------------------------------
Menu:              [0] Exit
[1] Sort BubleSort  [3] Shuffle & Print List
[2] Sort QuickSort  [4] Print List
-------------------------------------------
Selection: 2

Quick Sort Called
Product Name                                  Product ID  Price
------------                                  ----------  -----
Lamentations of the Flame Princess            1165822     $ 17.08
Premium Bookends for Shelves                  3958646     $ 17.73
Coleman Tent Kit                              4729011     $ 12.97
Lies My Teacher Told Me: History Textbook     5169007     $ 18.08
Vintage Canvas Shoulder Laptop Bag            5715451     $ 49.99
Batman Vol. 5: Zero Year - Dark City          6245816     $ 11.13
Flashlight Holster                            7400234     $  7.85
Bentgo Bag - Insulated Lunch Box Bag          7989021     $  9.99
Dungeon & Dragons: Dungeon Master's Guide 4E  8050622     $ 35.10
Vintage Travel Casual Daypack                 8277821     $ 26.74
Deluxe Reusable Grocery Bag w/ Bottle Sleeves 9249825     $ 25.95
Polyhedral 7-Die Scarab Dice Set              9379410     $  9.41

-------------------------------------------
Menu:              [0] Exit
[1] Sort BubleSort  [3] Shuffle & Print List
[2] Sort QuickSort  [4] Print List
-------------------------------------------
Selection: 0
```

Driver.java

```
package src;

import java.util.ArrayList;
import java.util.Collections;
import java.util.List;
import java.util.Scanner;

public class Driver {

    public static void main(String[] args) {
        List<Product> items = new ArrayList<Product>();
        items.add(new Product( 5715451, "Vintage Canvas Shoulder Laptop Bag", 49.99));
        items.add(new Product( 7989021, "Bentgo Bag - Insulated Lunch Box Bag",
9.99));
        items.add(new Product( 9379410, "Polyhedral 7-Die Scarab Dice Set", 9.41));
        items.add(new Product( 9249825, "Deluxe Reusable Grocery Bag w/ Bottle
Sleeves", 25.95));
        items.add(new Product( 4729011, "Coleman Tent Kit", 12.97));
        items.add(new Product( 7400234, "Flashlight Holster", 7.85));
        items.add(new Product( 3958646, "Premium Bookends for Shelves", 17.73));
        items.add(new Product( 8050622, "Dungeon & Dragons: Dungeon Master's Guide
4E", 35.10));
        items.add(new Product( 5169007, "Lies My Teacher Told Me: History Textbook",
18.08));
```

```
        items.add(new Product( 8277821, "Vintage Travel Casual Daypack", 26.74));
        items.add(new Product( 6245816, "Batman Vol. 5: Zero Year - Dark City",
11.13));
        items.add(new Product( 1165822, "Lamentations of the Flame Princess", 17.08));

        ISortingUtility sul = SuperSortingUtility.getSortingUtility();
        Scanner scanner = new Scanner(System.in);
        int menuSelection;
        do {
            printMenu();
            menuSelection = scanner.nextInt();
            switch(menuSelection) {
            case 1: case 2: items = sul.sort(items, menuSelection);
                            break;
            case 3:         shuffleList((List)items);
            case 4:         printList(items);
                            break;
                            default: break;
            }

        }while(menuSelection != 0);

    }

    /**
     * print driver menu
     */
    public static void printMenu() {

        System.out.println("\n-------------------------------------------");
        System.out.printf("%-19s [%d] %-20s\n","Menu:", 0, "Exit");
        System.out.printf("[%d] %-15s [%d] %-20s\n", 1, "Sort BubleSort", 3, "Shuffle
& Print List");
        System.out.printf("[%d] %-15s [%d] %-20s\n", 2, "Sort QuickSort", 4, "Print
List");
        System.out.println("-------------------------------------------");
        System.out.print("Selection: ");

    }

    /**
     * print product list using System.out.println(Product::toString())
     * @param items
     */
    public static void printList(List<Product> items) {
        System.out.println("** Default print using
System.out.println(Prodct::toString())");
        for(Object item: items) {
            System.out.println(item.toString());
        }
    }

    /**
     * Shuffle List
     * @param items
     */
    public static void shuffleList(List<Object> items) {
```

```
        System.out.println("\n** Shuffle List");
        int limmit = items.size();
        for(int i = 0; i < limmit; i++) {
            int ii = (int)Math.abs((i+Math.random()*(limmit-1-i)));
            Collections.swap(items, i, ii);
        }
    }

}
```

Product.java

```
package src;

public class Product {

    /**
     * general product ID
     */
    private int productID;

    /**
     * general product price s
     */
    private String productName;

    /**
     *
     */
    private float productPrice;

    /**
     * Overloaded constructor
     * @param productID     the product ID
     * @param productName   the product name
     * @param productPrice  the product price
     */
    public Product(int productID, String productName, double productPrice) {
        this(productID, productName, (float) productPrice);
    }
    public Product(int productID, String productName, float productPrice) {
        // TODO Auto-generated constructor stub
        this.productID = productID;
        this.productName = productName;
        this.productPrice = productPrice;
    }

    /**
     * @return the productID
     */
    public int getProductID(){
        return productID;
    }

    /**
     * @return the product name
     */
```


```
    public String getProductName() {
        return productName;
    }

    /**
     * @return the product price
     */
    public float getProductPrice() {
        return productPrice;
    }

    /**
     * @param name the name to set
     */
    public void setProductName(String name) {
        this.productName = name;
    }

    /**
     * @param price the price to set
     */
    public void setProductPrice(float price) {
        this.productPrice = price;
    }

    /**
     * @return String that describes the product
     */
    public String toString() {
        return String.valueOf(productID) + " - " + productName + " - $" +
String.valueOf(productPrice);
    }
}
```

SuperSortingUtility.java

```
package src;

public class SuperSortingUtility {

    public static ISortingUtility getSortingUtility(){
        return new SortingUtilityLog(new SortingUtility());
    }

}
```

ISortingUtility.java

```
package src;

import java.util.List;

public interface ISortingUtility {
    public List<Product> sort(List<Product> items, int sortingApproach);
}
```

SortingUtility.java

```
package src;

import java.util.List;
import java.util.Collections;

public class SortingUtility implements ISortingUtility {

    /**
     * Sort a list of Products
     * @param   items list of products to be sorted
     * @param   sortingApproach the sort method to be used 1 = bubble sort, 2 = quick
sort
     */
    public List<Product> sort(List<Product> items, int sortingApproach){
        switch(sortingApproach) {
        case 1:     items = bubbleSort(items);
                    break;
        case 2:     items = quickSort(items);
                    break;
        default:    break;
        }
        return items;
    }

    /**
     * Sort Product list using bubble sort algorithm
     * @param   items list of products to be sorted
     * @return the sorted list
     */
    private List<Product> bubbleSort(List<Product>  items){
        int max = items.size();
        for(int i = 0; i < max-1; i++) {
            for(int ii = i+1; ii < max ; ii++) {
                if(items.get(i).getProductID() > items.get(ii).getProductID()) {
                    Collections.swap(items, i, ii);
                }
            }
        }
        return items;
    }

    /**
     * Sort Product list using quick sort algorithm
     * @param   items list of products to be sorted
     * @return the sorted list
     */
    private List<Product> quickSort(List<Product>  items){
        quickSort(items, 0, items.size()-1);
        return items;
    }

    /**
     * sort list recursively
     * @param items the list of items
     * @param first starting index
```

```
     * @param last  ending index
     */
    private void quickSort(List<Product>  items, int first, int last) {
        int i = first;
        int ii = last;
        int pivotID = items.get((first + last)/2).getProductID();
        do {
            while(items.get(i).getProductID() < pivotID)
                i++;
            while(items.get(ii).getProductID() > pivotID)
                ii--;
            if(i <= ii) {
                Collections.swap(items, i, ii);
                i++;
                ii--;
            }
        }while(i <= ii);

        if(first < ii)
            quickSort(items, first, ii);
        if(i < last)
            quickSort(items, i, last);
    }
}
```

SortingUtilityLog.java

```
package src;

import java.lang.reflect.InvocationTargetException;
import java.lang.reflect.Method;
import java.util.List;

public class SortingUtilityLog implements ISortingUtility {
    /**
     * the original class that this is based on
     */
    private ISortingUtility sortingUtil_original;

    /**
     * Constructor
     * @param su
     */
    public SortingUtilityLog(ISortingUtility su) {
        this.sortingUtil_original = su;
    }

    /**
     * Get the specified sort method
     * @param method
     * @return Method, the found method
     * @throws NoSuchMethodException
     * @throws InvocationTargetException
     */
    private Method reflectionSortMethod(String method) throws NoSuchMethodException,
InvocationTargetException{
```

```
        Method sortMethod = sortingUtil_original.getClass().getDeclaredMethod(method,
List.class);
        sortMethod.setAccessible(true);
        return sortMethod;
    }

    /**
     * Sort a list of Products
     * @param   items list of products to be sorted
     * @param   sortingApproach the sort method to be used 1 = bubble sort, 2 = quick
sort
     */
    public List<Product> sort(List<Product> items, int sortingApproach){
        try {

            switch(sortingApproach) {
                case 1:     items = (List<Product>)
(this.reflectionSortMethod("bubbleSort")).invoke(sortingUtil_original, items);
                            bubbleSortPrint(items);
                            break;
                case 2:     items = (List<Product>)
(this.reflectionSortMethod("quickSort")).invoke(sortingUtil_original, items);
                            quickSortPrint(items);
                            break;
                default:    break;
            }
        }catch (NoSuchMethodException e) {
            System.out.println("No Such Method");
            e.printStackTrace();
        } catch (InvocationTargetException e) {
            e.printStackTrace();
        } catch(IllegalAccessException e) {}
        return items;
    }

    /**
     * Print the formatted list
     * @param items
     */
    private void bubbleSortPrint(List<Product> items) {
        System.out.println("\nBubble Sort Called");
        System.out.printf("%-11s %-50s %-7s\n", "Product ID", "Product Name",
"Price");
        System.out.printf("%-11s %-50s %-7s\n", "----------", "------------", "-----
");
        for(Product item: items) {
            System.out.printf("%-11d %-50s $%6.2f\n", item.getProductID(),
item.getProductName(), item.getProductPrice());
        }
    }

    /**
     * Print the formatted list
     * @param items
     */
    private void quickSortPrint(List<Product> items) {
        System.out.println("\nQuick Sort Called");
```

```
        System.out.printf("%-50s %-11s %-7s\n", "Product Name", "Product ID",
"Price");
        System.out.printf("%-50s %-11s %-7s\n", "------------", "----------", "-----
");
        for(Product item: items) {
            System.out.printf("%-50s %-11d $%6.2f\n", item.getProductName(),
item.getProductID(), item.getProductPrice());
        }
    }
}
```