Course: ENSF 614 – Fall 2023
Lab 6:
Instructor: M. Moussavi
Student Name: Emmanuel Alafonye
Submission Date: November 10, 2023.

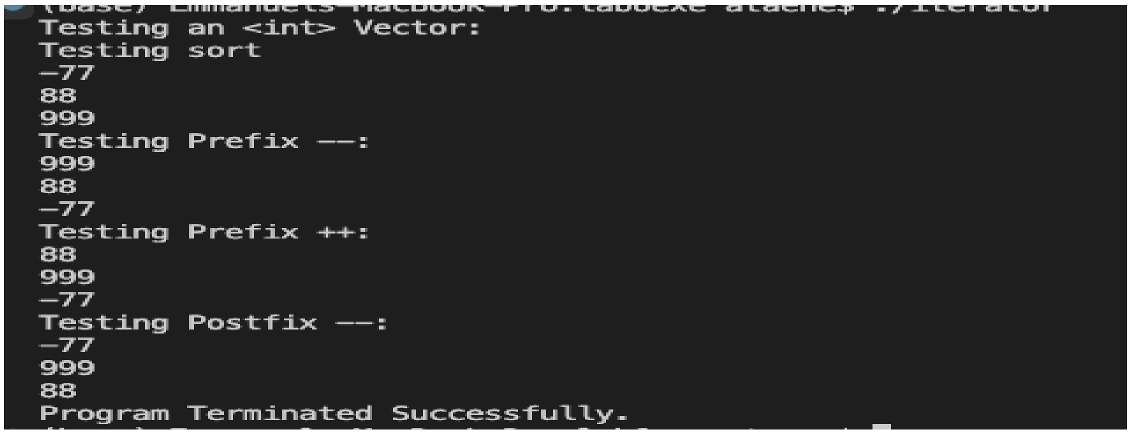
```
/*
* iterator.cpp
* File Name: lab6Exe_A.cpp
* Assignment: ENSF 614 Lab 6, exercise A
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex A
* Submission Date: 10 November, 2023.
*/


#include <iostream>
#include <algorithm> // Usde for sorting
#include <assert.h>
#include "mystring2.h" // Imported for Mystring

using namespace std;

// Define a template class Vector that can create vectors of different data types.

template <typename T>
class Vector
{
public:
// Nested class VectIter to represent an iterator for the Vector.
  class VectIter
  {
    friend class Vector;

  private:
    Vector *v; //Pointer to the parent object
    int index; // Represent the subscript number of the vectors

  public:
    // Constrcutor of the VectorIter
    VectIter(Vector &x) : v(&x), index(0) {}

    T operator++()
    {
      if (++index == v->size)
        index = 0;
      return v->array[index];
    }

    T operator++(int)
    {
      T temp = v->array[index++];
      if (index == v->size)
        index = 0;
      return temp;
    }
    T operator--()
    {
      if (index == 0)
        index = v->size - 1;
      else
        index--;
      return v->array[index];
    }

    T operator--(int)
    {
      T temp = v->array[index];
      if (index == 0)
        index = v->size - 1;
      else
        index--;
      return temp;
    }

    T operator*()
    {
      return v->array[index];
    }
  };
   // Constructor for Vector class.
  Vector(int sz) : size(sz)
  {
    array = new T[sz];
  }
  // Destructor for Vector class.
  ~Vector()
  {
    delete[] array;
  }
  // Overload the subscript operator ([]).
  T &operator[](int i)
  {
    return array[i];
  }

  // Sort the vector's elements in ascending order using the STL sort function.
  void ascending_sort()
  {
    sort(array, array + size);
  }

private:
  T *array; // Pointer to the first element of the array
  int size; // Array size
};
```

```
// Main entry of the program
int main()
{
  Vector<int> x(3);
  x[0] = 999;
  x[1] = -77;
  x[2] = 88;
  // Creates and iterator for the integer Vector
  Vector<int>::VectIter iter(x);

  cout << "Testing an <int> Vector:" << endl;
  cout << "Testing sort" << endl;
  x.ascending_sort();

  for (int i = 0; i < 3; i++)
    cout << iter++ << endl;

  cout << "Testing Prefix --:" << endl;
  for (int i = 0; i < 3; i++)
    cout << --iter << endl;

  cout << "Testing Prefix ++:" << endl;
  for (int i = 0; i < 3; i++)
    cout << ++iter << endl;

  cout << "Testing Postfix --:" << endl;
  for (int i = 0; i < 3; i++)
    cout << iter-- << endl;

  cout << "Program Terminated Successfully." << endl;

  return 0;
}


/*
* iterator.cpp
* File Name: lab6Exe_A.cpp
* Assignment: ENSF 614 Lab 6, exercise A
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex A
* Submission Date: 10 November, 2023.
*/

#include "mystring2.h"
#include <string.h>
#include <iostream>
using namespace std;
```

```
Mystring::Mystring()
{
  charsM = new char[1];
  charsM[0] = '\0';
  lengthM = 0;
}

Mystring::Mystring(const char *s)
  : lengthM(strlen(s))
{
  charsM = new char[lengthM + 1];
  strcpy(charsM, s);
}

Mystring::Mystring(int n)
  : lengthM(0), charsM(new char[n])
{
  charsM[0] = '\0';
}

Mystring::Mystring(const Mystring& source):
  lengthM(source.lengthM), charsM(new char[source.lengthM+1])
{
  strcpy (charsM, source.charsM);
}

Mystring::~Mystring()
{
  delete [] charsM;
}

int Mystring::length() const
{
  return lengthM;
}

char Mystring::get_char(int pos) const
{
  if(pos < 0 && pos >= length()){
    cerr << "\nERROR: get_char: the position is out of boundary." ;
  }

  return charsM[pos];
}

const char * Mystring::c_str() const
{
  return charsM;
```

```
}

void Mystring::set_char(int pos, char c)
{
  if(pos < 0 && pos >= length()){
    cerr << "\nset_char: the position is out of boundary."
          << " Nothing was changed.";
    return;
  }

  if (c != '\0'){
    cerr << "\nset_char: char c is empty."
          << " Nothing was changed.";
    return;
  }

  charsM[pos] = c;
}

Mystring& Mystring::operator =(const Mystring& S)
{
  if(this == &S)
    return *this;
  delete [] charsM;
  lengthM = (int) strlen(S.charsM);
  charsM = new char [lengthM+1];
  strcpy(charsM,S.charsM);
  return *this;
}

Mystring& Mystring::append(const Mystring& other)
{
  char *tmp = new char [lengthM + other.lengthM + 1];
  lengthM+=other.lengthM;
  strcpy(tmp, charsM);
  strcat(tmp, other.charsM);
  delete []charsM;
  charsM = tmp;

  return *this;
}

 void Mystring::set_str(char* s)
{
    delete []charsM;
    lengthM = (int) strlen(s);
    charsM=new char[lengthM+1];

    strcpy(charsM, s);
```

```
}

/*
* iterator.cpp
* File Name: lab6Exe_A.cpp
* Assignment: ENSF 614 Lab 6, exercise A
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex A
* Submission Date: 10 November, 2023.
*/


#ifndef MYSTRING_H
#define MYSTRING_H

class Mystring {
 public:
  Mystring();
  // PROMISES: Empty string object is created.

  Mystring(int n);
  // PROMISES: Creates an empty string with a total capacity of n.
  //          In other words, dynamically allocates n elements for
  //          charsM,sets the lengthM to zero, and fills the first
  //          element of charsM with '\0'.

  Mystring(const char *s);
  // REQUIRES: s points to first char of a built-in string.
  // REQUIRES: Mystring object is created by copying chars from s.

  ~Mystring(); // destructor

  Mystring(const Mystring& source); // copy constructor

  Mystring& operator =(const Mystring& rhs); // assignment operator
  // REQUIRES: rhs is reference to a Mystring as a source
  // PROMISES: to make this-object (object that this is pointing to, as  a copy
  //          of rhs.

  int length() const;
  // PROMISES: Return value is number of chars in charsM.

  char get_char(int pos) const;
  // REQUIRES: pos >= 0 && pos < length()
  // PROMISES:
  // Return value is char at position pos.
  // (The first char in the charsM is at position 0.)
  const char * c_str() const;
  // PROMISES:
  //   Return value points to first char in built-in string
  //   containing the chars of the string object.

  void set_char(int pos, char c);
  // REQUIRES: pos >= 0 && pos < length(), c != '\0'
  // PROMISES: Character at position pos is set equal to c.

  Mystring& append(const Mystring& other);

  // PROMISES: extends the size of charsM to allow concatenate other.charsM to
  //          to the end of charsM. For example if charsM points to "ABC", and
  //         other.charsM points to XYZ, extends charsM to "ABCXYZ".
  //

  void set_str(char* s);
  // REQUIRES: s is a valid C++ string of characters (a built-in string)
  // PROMISES:copys s into charsM, if the length of s is less than or equal lengthM.
  //         Othrewise, extends the size of the charsM to s.lengthM+1, and copies
  //         s into the charsM.

 private:

  int lengthM; // the string length - number of characters excluding \0
  char* charsM; // a pointer to the beginning of an array of characters, allocated dynamically.
  void memory_check(char* s);
  // PROMISES: if s points to NULL terminates the program.
};
#endif
```



```
Testing an <int> Vector:
Testing sort
-77
88
999
Testing Prefix --:
999
88
-77
Testing Prefix ++:
88
999
-77
Testing Postfix --:
-77
999
88
Program Terminated Successfully.
```

Exercise B

```
/*
* iterator.cpp
* File Name: lab6Exe_B.cpp
* Assignment: ENSF 614 Lab 6, exercise B
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex B
* Submission Date: 10 November, 2023.
*/

import java.util.Random;

public class DemoStrategyPattern {
	public static void main(String[] args) {
		// Create an object of MyVector<Double> with a capacity of 50 elements
		MyVector<Double> v1 = new MyVector<>(50);

		// Create a Random object to generate values between 0
		Random rand = new Random();

		// Adding 5 randomly generated numbers into MyVector object v1
		for (int i = 4; i >= 0; i--) {
			Item<Double> item = new Item<>(rand.nextDouble() * 100);
			v1.add(item);
		}

		// Displaying original data in MyVector v1
		System.out.println("The original values in v1 object are:");
		v1.display();

		// Choose the bubble sort algorithm as a strategy to sort object v1
		v1.setSortStrategy(new BubbleSorter<>());

		// Perform algorithm bubble sort on v1
		v1.performSort();

		System.out.println("\nThe values in MyVector object v1 after performing BubbleSorter are:");
		v1.display();

		// Create a MyVector<Integer> object v2
		MyVector<Integer> v2 = new MyVector<>(50);

		// Populate v2 with 5 randomly generated numbers
		for (int i = 4; i >= 0; i--) {
			Item<Integer> item = new Item<>(rand.nextInt(50));
			v2.add(item);
		}

		System.out.println("\nThe original values in v2 object are:");
```

```
                    v2.display();
                    v2.setSortStrategy(new InsertionSorter<>());
                    v2.performSort();

                    System.out.println("\nThe values in MyVector object v2 after performing InsertionSorter are:");
                    v2.display();
          }
}


/*
* iterator.cpp
* File Name: lab6Exe_B.cpp
* Assignment: ENSF 614 Lab 6, exercise B
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex B
* Submission Date: 10 November, 2023.
*/

import java.util.ArrayList;

// BubbleSorter class implementing the Sorter interface
public class BubbleSorter<E extends Number & Comparable<E>> implements Sorter<E> {
    @Override
    public void sort(ArrayList<Item<E>> items) {
        // Bubble sort algorithm
        int n = items.size();
        boolean swapped;
        do {
            swapped = false;
            for (int i = 1; i < n; i++) {
                if (items.get(i - 1).getItem().compareTo(items.get(i).getItem()) > 0) {
                    // Swap items
                    Item<E> temp = items.get(i - 1);
                    items.set(i - 1, items.get(i));
                    items.set(i, temp);
                    swapped = true;
                }
            }
        } while (swapped);
    }
}

/*
* iterator.cpp
* File Name: lab6Exe_B.cpp
* Assignment: ENSF 614 Lab 6, exercise B
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex B
* Submission Date: 10 November, 2023.
*/

import java.util.ArrayList;

// InsertionSorter class implementing the Sorter interface
public class InsertionSorter<E extends Number & Comparable<E>> implements Sorter<E> {
    public void sort(ArrayList<Item<E>> items) {
        // Insertion sort algorithm
        int n = items.size();
        for (int i = 1; i < n; i++) {
            Item<E> key = items.get(i);
            int j = i - 1;
            while (j >= 0 && items.get(j).getItem().compareTo(key.getItem()) > 0) {
                items.set(j + 1, items.get(j));
                j--;
            }
            items.set(j + 1, key);
        }
    }
}

/*
* iterator.cpp
* File Name: lab6Exe_B.cpp
* Assignment: ENSF 614 Lab 6, exercise B
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex B
* Submission Date: 10 November, 2023.
*/


public class Item<E extends Number & Comparable<E>> {
    private E item;

    public Item(E value) {
        item = value;
    }

    public void setItem(E value) {
        item = value;
    }

    public E getItem() {
        return item;
    }
}

/*
* iterator.cpp
* File Name: lab6Exe_B.cpp
* Assignment: ENSF 614 Lab 6, exercise B
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* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex B
* Submission Date: 10 November, 2023.
*/


import java.util.ArrayList;

// MyVector class for managing a collection of items with sorting strategies
public class MyVector<E extends Number & Comparable<E>> {
    private ArrayList<Item<E>> storageM;
    private Sorter<E> sorter;

    public MyVector(int n) {
        storageM = new ArrayList<>(n);
    }

    public MyVector(ArrayList<Item<E>> arr) {
        storageM = new ArrayList<>(arr);
    }

    public void add(Item<E> value) {
        storageM.add(value);
    }

    public void setSortStrategy(Sorter<E> s) {
        sorter = s;
    }

    public void performSort() {
        sorter.sort(storageM);
    }

    public void display() {
        for (Item<E> item : storageM) {
            System.out.print(item.getItem() + " ");
        }
        System.out.println();
    }
}

/*
```
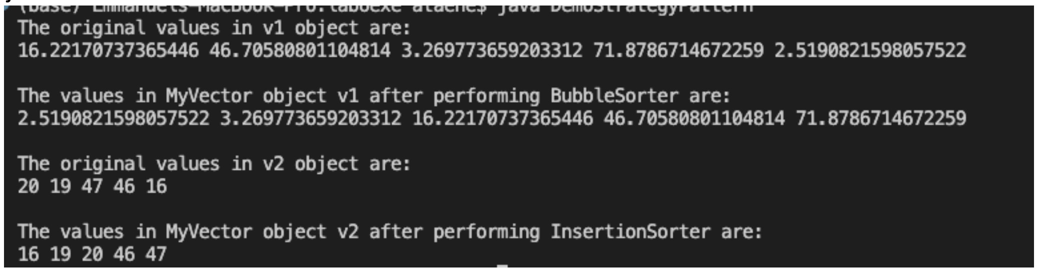

```
* iterator.cpp
* File Name: lab6Exe_B.cpp
* Assignment: ENSF 614 Lab 6, exercise B
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex B
* Submission Date: 10 November, 2023.
*/


import java.util.ArrayList;

// Interface for sorter classes
public interface Sorter<E extends Number & Comparable<E>> {
   void sort(ArrayList<Item<E>> items);
}
```

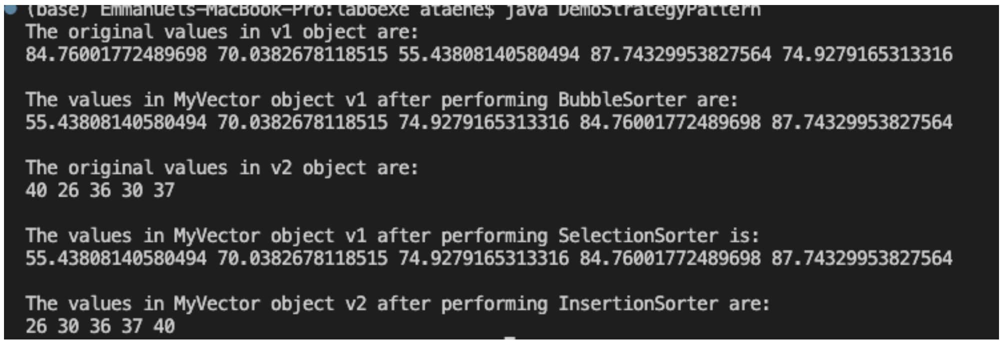


```
The original values in v1 object are:
16.22170737365446 46.70580801104814 3.269773659203312 71.8786714672259 2.5190821598057522

The values in MyVector object v1 after performing BubbleSorter are:
2.5190821598057522 3.269773659203312 16.22170737365446 46.70580801104814 71.8786714672259

The original values in v2 object are:
20 19 47 46 16

The values in MyVector object v2 after performing InsertionSorter are:
16 19 20 46 47
```

Exercise C

```
/*
* iterator.cpp
* File Name: lab6Exe_C.cpp
* Assignment: ENSF 614 Lab 6, exercise C
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex C
* Submission Date: 10 November, 2023.
*/

import java.util.ArrayList;

public class SelectionSorter<E extends Number & Comparable<E>> implements Sorter<E> {
   @Override
   public void sort(ArrayList<Item<E>> items) {
      // Selection sort algorithm
      int n = items.size();

      for (int i = 0; i < n - 1; i++) {
         int minIndex = i;

         for (int j = i + 1; j < n; j++) {
            if (items.get(j).getItem().compareTo(items.get(minIndex).getItem()) < 0) {
               minIndex = j;
            }
        }
        // Swap items
        Item<E> temp = items.get(minIndex);
        items.set(minIndex, items.get(i));
        items.set(i, temp);
      }
    }
}


/*
* iterator.cpp
* File Name: lab6Exe_B.cpp
* Assignment: ENSF 614 Lab 6, exercise B
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex B
* Submission Date: 10 November, 2023.
*/

import java.util.Random;

public class DemoStrategyPattern {
        public static void main(String[] args) {
                // Create an object of MyVector<Double> with a capacity of 50 elements
                MyVector<Double> v1 = new MyVector<>(50);

                // Create a Random object to generate values between 0
                Random rand = new Random();

                // Adding 5 randomly generated numbers into MyVector object v1
                for (int i = 4; i >= 0; i--) {
                        Item<Double> item = new Item<>(rand.nextDouble() * 100);
                        v1.add(item);
                }

                // Displaying original data in MyVector v1
                System.out.println("The original values in v1 object are:");
                v1.display();

                // Choose the bubble sort algorithm as a strategy to sort object v1
                v1.setSortStrategy(new BubbleSorter<>());
                v1.setSortStrategy(new SelectionSorter<>());

                // Perform algorithm bubble sort on v1
                v1.performSort();

                System.out.println("\nThe values in MyVector object v1 after performing BubbleSorter are:");
```

```
		v1.display();

		// Create a MyVector<Integer> object v2
		MyVector<Integer> v2 = new MyVector<>(50);

		// Populate v2 with 5 randomly generated numbers
		for (int i = 4; i >= 0; i--) {
			Item<Integer> item = new Item<>(rand.nextInt(50));
			v2.add(item);
		}

		System.out.println("\nThe original values in v2 object are:");
		v1.performSort();
		v2.display();
		v2.setSortStrategy(new InsertionSorter<>());
		v2.performSort();

		System.out.println("\nThe values in MyVector object v1 after performing SelectionSorter is:");
		v1.display();
		System.out.println("\nThe values in MyVector object v2 after performing InsertionSorter are:");
		v2.display();
	}
}
```

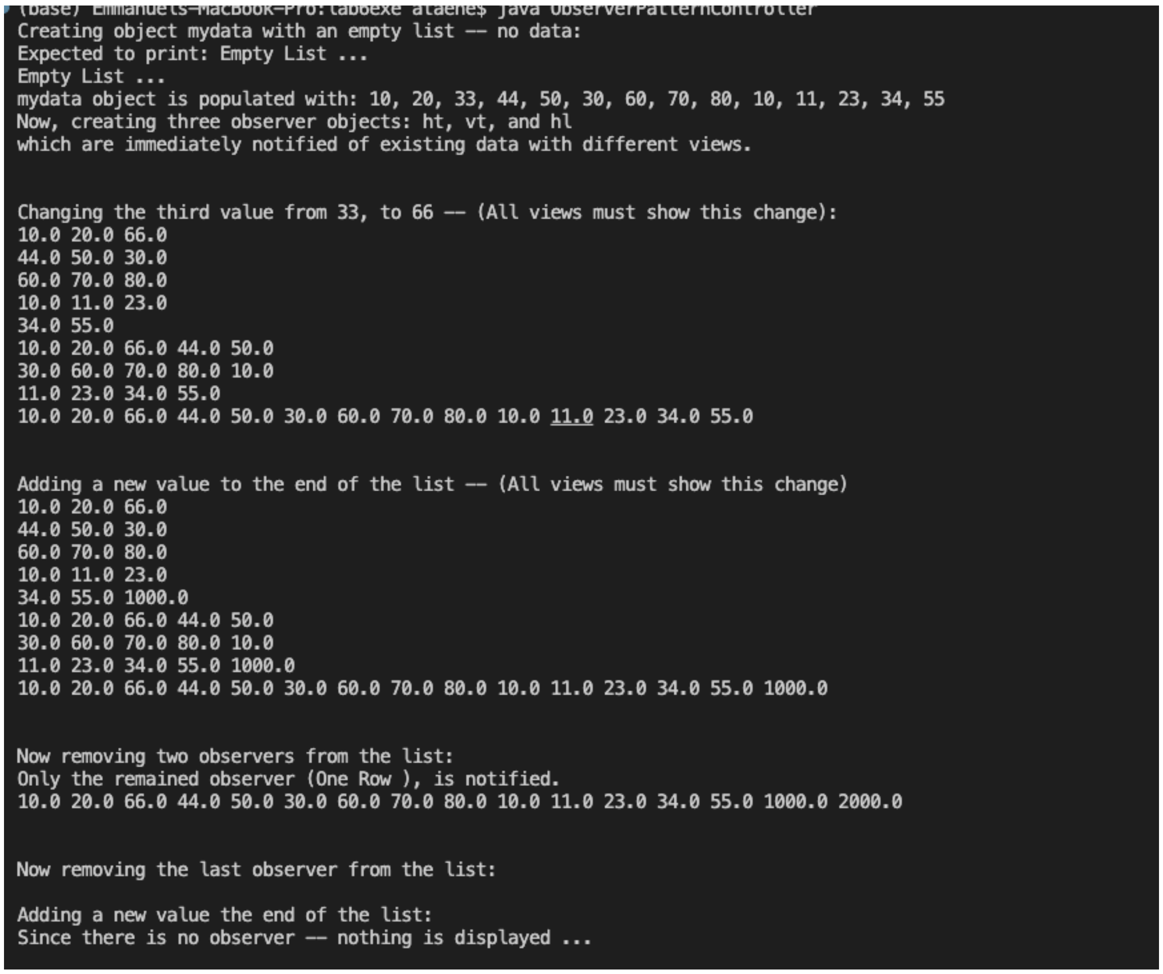


```
(base) Emmanuels-MacBook-Pro:lab6exe ataene$ java DemoStrategyPattern
The original values in v1 object are:
84.76001772489698 70.0382678118515 55.43808140580494 87.74329953827564 74.9279165313316

The values in MyVector object v1 after performing BubbleSorter are:
55.43808140580494 70.0382678118515 74.9279165313316 84.76001772489698 87.74329953827564

The original values in v2 object are:
40 26 36 30 37

The values in MyVector object v1 after performing SelectionSorter is:
55.43808140580494 70.0382678118515 74.9279165313316 84.76001772489698 87.74329953827564

The values in MyVector object v2 after performing InsertionSorter are:
26 30 36 37 40
```

Exercise D

```
/*
* OberserverPatternController.cpp
* File Name: lab6Exe_D.cpp
* Assignment: ENSF 614 Lab 6, exercise D
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex D
* Submission Date: 10 November, 2023.
*/


public class ObserverPatternController {
	public static void main(String []s) {
		double [] arr = {10, 20, 33, 44, 50, 30, 60, 70, 80, 10, 11, 23, 34, 55};
```

```
                    System.out.println("Creating object mydata with an empty list -- no data:");
                    DoubleArrayListSubject mydata = new DoubleArrayListSubject();
                    System.out.println("Expected to print: Empty List ...");
                    mydata.display();
                    mydata.populate(arr);
                    System.out.println("mydata object is populated with: 10, 20, 33, 44, 50, 30, 60, 70, 80, 10, 11, 23,
34, 55 ");
                    System.out.print("Now, creating three observer objects: ht, vt, and hl ");
                    System.out.println("\nwhich are immediately notified of existing data with different views.");
                    ThreeColumnTable_Observer ht = new ThreeColumnTable_Observer(mydata);
                    FiveRowsTable_Observer vt = new FiveRowsTable_Observer(mydata);
                    OneRow_Observer hl = new OneRow_Observer(mydata);
                    System.out.println("\n\nChanging the third value from 33, to 66 -- (All views must show this
change):");
                    mydata.setData(66.0, 2);
                    System.out.println("\n\nAdding a new value to the end of the list -- (All views must show this
change)");
                    mydata.addData(1000.0);
                    System.out.println("\n\nNow removing two observers from the list:");
                    mydata.remove(ht);
                    mydata.remove(vt);
                    System.out.println("Only the remained observer (One Row ), is notified.");
                    mydata.addData(2000.0);
                    System.out.println("\n\nNow removing the last observer from the list:");
                    mydata.remove(hl);
                    System.out.println("\nAdding a new value the end of the list:");
                    mydata.addData(3000.0);
                    System.out.println("Since there is no observer -- nothing is displayed ...");
                    System.out.print("\nNow, creating a new Three-Column observer that will be notified of existing
data:");
                    ht = new ThreeColumnTable_Observer(mydata);
          }
}

/*
* OberserverPatternController.cpp
* File Name: lab6Exe_D.cpp
* Assignment: ENSF 614 Lab 6, exercise D
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex D
* Submission Date: 10 November, 2023.
*/


import java.util.ArrayList;

// This interface defines the contract for all observers in the observer pattern.
public interface Observer {
    void update(ArrayList<Double> data);
}

/*
* OberserverPatternController.cpp
* File Name: lab6Exe_D.cpp
* Assignment: ENSF 614 Lab 6, exercise D
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex D
* Submission Date: 10 November, 2023.
*/

public interface Subject {
    void register(Observer observer); // Register the observer
    void remove(Observer observer);
    void notifyObservers(); // Notify all registered Oberser.
}
/*
* OberserverPatternController.cpp
* File Name: lab6Exe_D.cpp
* Assignment: ENSF 614 Lab 6, exercise D
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex D
* Submission Date: 10 November, 2023.
*/

import java.util.ArrayList;
// Represent the subject in the observer patter
public class DoubleArrayListSubject implements Subject {
    private ArrayList<Observer> observers = new ArrayList<>();
    private ArrayList<Double> data = new ArrayList<>();

    @Override
    public void register(Observer observer) {
        observers.add(observer);
    }

    @Override
    public void remove(Observer observer) {
        observers.remove(observer);
    }

    @Override
    public void notifyObservers() {
        for (Observer observer : observers) {
            observer.update(data);
        }
    }
    // Add or populate the array double
    public void addData(Double value) {
        data.add(value);
        notifyObservers();
    }

    public void setData(Double value, int index) {
        if (index >= 0 && index < data.size()) {
            data.set(index, value);
            notifyObservers();
        }
    }
    // Displays the current data list
    public void populate(double[] values) {
        for (double value : values) {
            data.add(value);
        }
        notifyObservers();
    }

    public void display() {
        if (data.isEmpty()) {
            System.out.println("Empty List ...");
        } else {
            for (Double value : data) {
                System.out.print(value + " ");
            }
            System.out.println();
        }
    }
}
/*
* OberserverPatternController.cpp
* File Name: lab6Exe_D.cpp
* Assignment: ENSF 614 Lab 6, exercise D
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex D
* Submission Date: 10 November, 2023.
*/


import java.util.ArrayList;
// Concrete Observer displays rows

public class FiveRowsTable_Observer implements Observer {
    private ArrayList<Double> data;
    // Constructor function to register this oberserver
    public FiveRowsTable_Observer(Subject subject) {
        subject.register(this);
    }

    @Override
    public void update(ArrayList<Double> data) {
        this.data = data;
        display();
    }
    // Display the data in 5 rows and columns
    public void display() {
        int numRows = (int) Math.ceil(data.size() / 5.0);
        for (int i = 0; i < numRows; i++) {
            for (int j = 0; j < 5; j++) {
                int index = i * 5 + j;
                if (index < data.size()) {
                    System.out.print(data.get(index) + " ");
                }
            }
            System.out.println();
        }
    }
}
/*
* OberserverPatternController.cpp
* File Name: lab6Exe_D.cpp
* Assignment: ENSF 614 Lab 6, exercise D
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex D
* Submission Date: 10 November, 2023.
*/

import java.util.ArrayList;

// This represents a concrete observer data in a three-column format.
public class ThreeColumnTable_Observer implements Observer {
    private ArrayList<Double> data;

    public ThreeColumnTable_Observer(Subject subject) {
        subject.register(this);
    }

    @Override
    public void update(ArrayList<Double> data) {
        this.data = data;
        display();
    }
    // Display method to show data in three columns.
    public void display() {
        int numRows = (int) Math.ceil(data.size() / 3.0);
        for (int i = 0; i < numRows; i++) {
            for (int j = 0; j < 3; j++) {
                int index = i * 3 + j;
                if (index < data.size()) {
                    System.out.print(data.get(index) + " ");
                }
            }
            System.out.println();
        }
    }
}

/*
* OberserverPatternController.cpp
* File Name: lab6Exe_D.cpp
* Assignment: ENSF 614 Lab 6, exercise D
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex D
* Submission Date: 10 November, 2023.
*/


import java.util.ArrayList;
// This concrete observer displays single row data
public class OneRow_Observer implements Observer {
    private ArrayList<Double> data;

    public OneRow_Observer(Subject subject) {
        subject.register(this);
    }
    // Update the data to be displayed
    @Override
    public void update(ArrayList<Double> data) {
        this.data = data;
        display();
    }
    // Displays the data
    public void display() {
        for (Double value : data) {
            System.out.print(value + " ");
        }
        System.out.println();
    }
}
```



```
(base) Emmanuels-MacBook-Pro:lab6exe alaene$ java ObserverPatternController
Creating object mydata with an empty list -- no data:
Expected to print: Empty List ...
Empty List ...
mydata object is populated with: 10, 20, 33, 44, 50, 30, 60, 70, 80, 10, 11, 23, 34, 55
Now, creating three observer objects: ht, vt, and hl
which are immediately notified of existing data with different views.


Changing the third value from 33, to 66 -- (All views must show this change):
10.0 20.0 66.0
44.0 50.0 30.0
60.0 70.0 80.0
10.0 11.0 23.0
34.0 55.0
10.0 20.0 66.0 44.0 50.0
30.0 60.0 70.0 80.0 10.0
11.0 23.0 34.0 55.0
10.0 20.0 66.0 44.0 50.0 30.0 60.0 70.0 80.0 10.0 11.0 23.0 34.0 55.0


Adding a new value to the end of the list -- (All views must show this change)
10.0 20.0 66.0
44.0 50.0 30.0
60.0 70.0 80.0
10.0 11.0 23.0
34.0 55.0 1000.0
10.0 20.0 66.0 44.0 50.0
30.0 60.0 70.0 80.0 10.0
11.0 23.0 34.0 55.0 1000.0
10.0 20.0 66.0 44.0 50.0 30.0 60.0 70.0 80.0 10.0 11.0 23.0 34.0 55.0 1000.0


Now removing two observers from the list:
Only the remained observer (One Row ), is notified.
10.0 20.0 66.0 44.0 50.0 30.0 60.0 70.0 80.0 10.0 11.0 23.0 34.0 55.0 1000.0 2000.0


Now removing the last observer from the list:

Adding a new value the end of the list:
Since there is no observer -- nothing is displayed ...
```

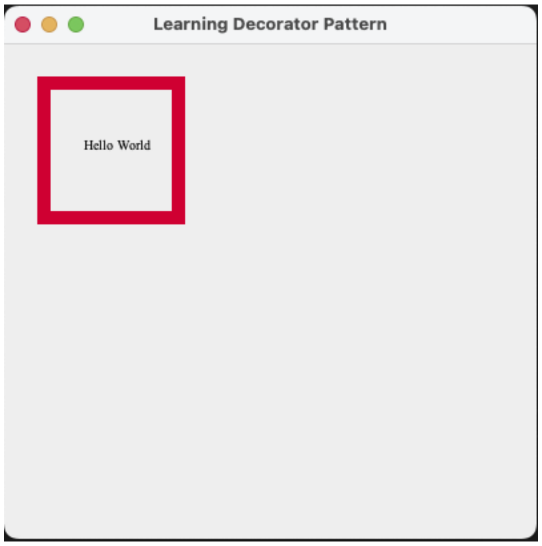
Exercise E

```
/*
* DemoDecoratorPatter.java
* File Name: lab6Exe_E.cpp
* Assignment: ENSF 614 Lab 6, exercise E
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex E
* Submission Date: 10 November, 2023.
*/

import java.awt.Font;
import java.awt.Graphics;
import javax.swing.JFrame;
import javax.swing.JPanel;


public class DemoDecoratorPattern extends JPanel {
        Component t;

    public DemoDecoratorPattern(){
            t = new Text ("Hello World", 60, 80);
    }
```

```
   public void paintComponent(Graphics g){
            int fontSize = 10;
            g.setFont(new Font("TimesRoman", Font.PLAIN, fontSize));

            // Now lets decorate t with BorderDecorator: x = 30, y = 30, width = 100, and height 100
            t = new BorderDecorator(t, 30, 30, 100, 100);

            // Now lets add a ColouredFrameDecorator with x = 25, y = 25, width = 110, height = 110,
                   // and thickness = 10.
            t = new ColouredFrameDecorator(t, 25, 25, 110, 110, 10);

            // Now lets draw the product on the screen
            t.draw(g);
   }

         public static void main(String[] args) {
      DemoDecoratorPattern panel = new DemoDecoratorPattern();
      JFrame frame = new JFrame("Learning Decorator Pattern");
      frame.getContentPane().add(panel);
      frame.setSize(400,400);
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      frame.setLocationRelativeTo(null);
      frame.setVisible(true);
         }
}


/*
* DemoDecoratorPatter.java
* File Name: lab6Exe_E.cpp
* Assignment: ENSF 614 Lab 6, exercise E
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex E
* Submission Date: 10 November, 2023.
*/

import java.awt.Color;
import java.awt.Graphics;

/**
 * The ColouredFrameDecorator class is responsible for adding a colored frame around a component.
 */
public class ColouredFrameDecorator implements Component {
   private Component component;
   private int x;
   private int y;
   private int width;
```

```
    private int height;
    private int thickness;

    public ColouredFrameDecorator(Component component, int x, int y, int width, int height, int thickness) {
        this.component = component;
        this.x = x;
        this.y = y;
        this.width = width;
        this.height = height;
        this.thickness = thickness;
    }

    @Override
    public void draw(Graphics g) {
        component.draw(g);
        g.setColor(Color.RED);
        for (int i = 0; i < thickness; i++) {
            g.drawRect(x + i, y + i, width - 2 * i, height - 2 * i);
        }
    }
}

/*
* DemoDecoratorPatter.java
* File Name: lab6Exe_E.cpp
* Assignment: ENSF 614 Lab 6, exercise E
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex E
* Submission Date: 10 November, 2023.
*/

import java.awt.Graphics;
/**
     * Draws the object using the provided Graphics object.
     */

public interface Component {
    void draw(Graphics g);
}

/*
* DemoDecoratorPatter.java
* File Name: lab6Exe_E.cpp
* Assignment: ENSF 614 Lab 6, exercise E
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex E
* Submission Date: 10 November, 2023.
```

```
*/

import java.awt.Graphics;
// Represent component to be drawned
public class Text implements Component {
    private String text;
    private int x;
    private int y;

    public Text(String text, int x, int y) {
        this.text = text; // The diplayed Text
        this.x = x;
        this.y = y;
    }
    // Draws the text on the Graphics
    @Override
    public void draw(Graphics g) {
        g.drawString(text, x, y);
    }
}

/*
* DemoDecoratorPatter.java
* File Name: lab6Exe_E.cpp
* Assignment: ENSF 614 Lab 6, exercise E
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex E
* Submission Date: 10 November, 2023.
*/

import java.awt.Graphics;
// The BorderDecorator class is responsible for decorating a component.
public class BorderDecorator implements Component {
    private Component component;
    private int x;
    private int y;
    private int width;
    private int height;

    public BorderDecorator(Component component, int x, int y, int width, int height) {
        this.component = component;
        this.x = x;
        this.y = y;
        this.width = width;
        this.height = height;
    }
  /**
     * Draws the component with the added border on the provided Graphics object.
     *
     * @param g The Graphics object to draw the component with a border.
     */

    @Override
    public void draw(Graphics g) {
        component.draw(g);
    }
}
```

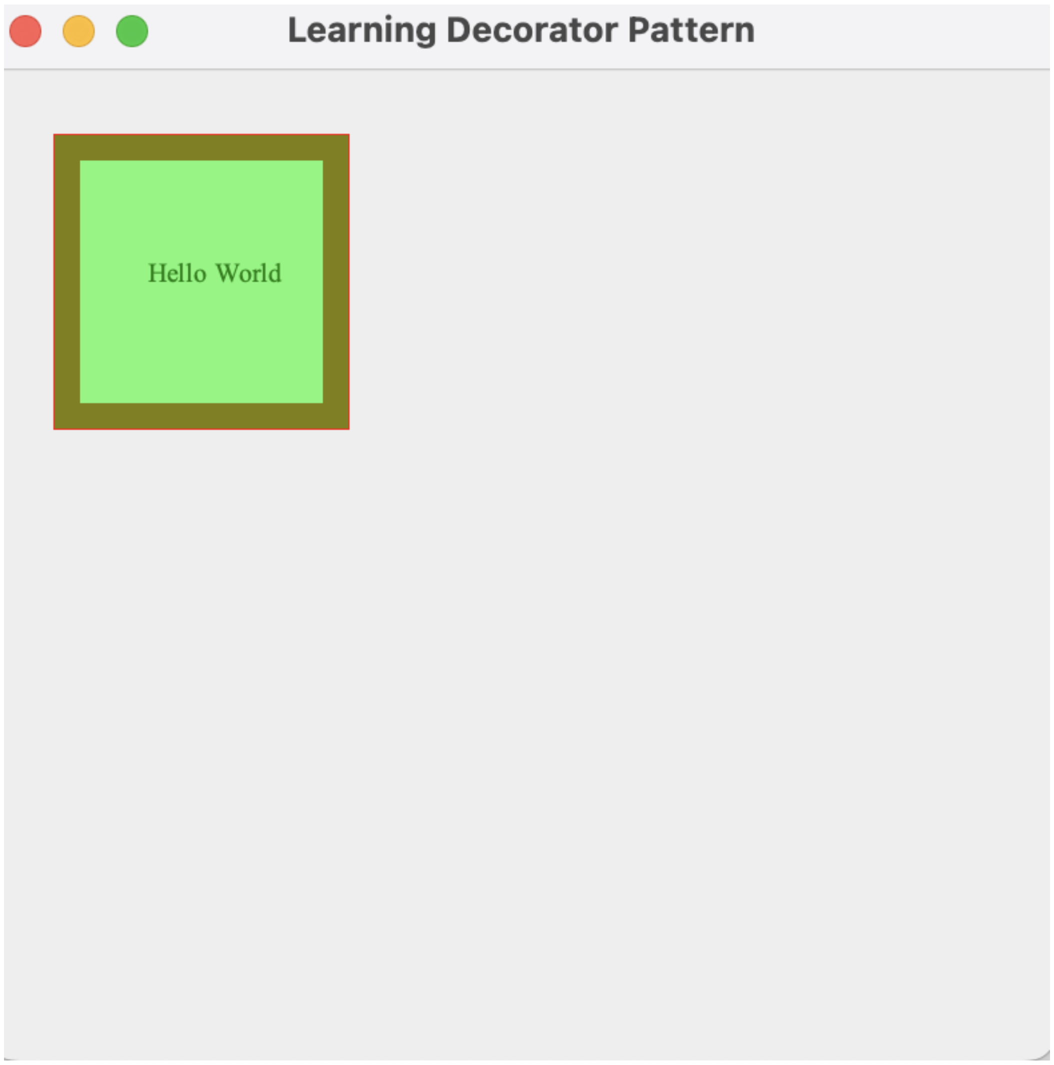


Exercise F

```
/*
* DemoDecoratorPatter.java
* File Name: lab6Exe_E.cpp
* Assignment: ENSF 614 Lab 6, exercise E
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex E
* Submission Date: 10 November, 2023.
*/

import java.awt.Font;
import java.awt.Graphics;
import javax.swing.JFrame;
import javax.swing.JPanel;


public class DemoDecoratorPattern extends JPanel {
        Component t;

    public DemoDecoratorPattern(){
          t = new Text ("Hello World", 60, 80);
```

```
  }

   // public void paintComponent(Graphics g){
          //     int fontSize = 10;
          //     g.setFont(new Font("TimesRoman", Font.PLAIN, fontSize));

          //     // Now lets decorate t with BorderDecorator: x = 30, y = 30, width = 100, and height 100
          //     t = new BorderDecorator(t, 30, 30, 100, 100);

          //     // Now lets add a ColouredFrameDecorator with x = 25, y = 25, width = 110, height = 110,
          //          // and thickness = 10.
          //     t = new ColouredFrameDecorator(t, 25, 25, 110, 110, 10);

          //     // Now lets draw the product on the screen
          //     t.draw(g);
   // }

                    /*
          * DemoDecoratorPatter.java
          * File Name: lab6Exe_F.cpp
          * Assignment: ENSF 614 Lab 6, exercise F
          * Created by Mahmood Moussavi
          * Completed by: Emmanuel Alafonye
          * ENSF 614 - Fall 2023 - Lab 6, Ex F
          * Submission Date: 10 November, 2023.
          */

          public void paintComponent(Graphics g) {
                    int fontSize = 10;
                    g.setFont(new Font("TimesRoman", Font.PLAIN, fontSize));

                    // Decorate 't' with a ColouredGlassDecorator, ColouredFrameDecorator, and BorderDecorator.
                    t = new ColouredGlassDecorator(new ColouredFrameDecorator(new BorderDecorator(t, 30, 30,
100, 100), 25, 25, 110, 110, 10), 25, 25, 110, 110);

                    t.draw(g);
          }


          public static void main(String[] args) {
      DemoDecoratorPattern panel = new DemoDecoratorPattern();
      JFrame frame = new JFrame("Learning Decorator Pattern");
      frame.getContentPane().add(panel);
      frame.setSize(400,400);
      frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      frame.setLocationRelativeTo(null);
      frame.setVisible(true);
          }
}
```

```
/*
* DemoDecoratorPatter.java
* File Name: lab6Exe_F.cpp
* Assignment: ENSF 614 Lab 6, exercise F
* Created by Mahmood Moussavi
* Completed by: Emmanuel Alafonye
* ENSF 614 - Fall 2023 - Lab 6, Ex F
* Submission Date: 10 November, 2023.
*/

import java.awt.Graphics;
import java.awt.Color;
import java.awt.Graphics2D;

public class ColouredGlassDecorator implements Component {
    private Component component;
    private int x;
    private int y;
    private int width;
    private int height;

    public ColouredGlassDecorator(Component component, int x, int y, int width, int height) {
        this.component = component;
        this.x = x;
        this.y = y;
        this.width = width;
        this.height = height;
    }

    @Override
    public void draw(Graphics g) {
        component.draw(g);

        // Add green glass cover with transparency
        Graphics2D g2d = (Graphics2D) g;
        g2d.setColor(new Color(0, 255, 0, 128));  // Transparent green color
        g2d.fillRect(x, y, width, height);
    }
}
```


Learning Decorator Pattern
Hello World