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Assignment 6

COMP 2230_02

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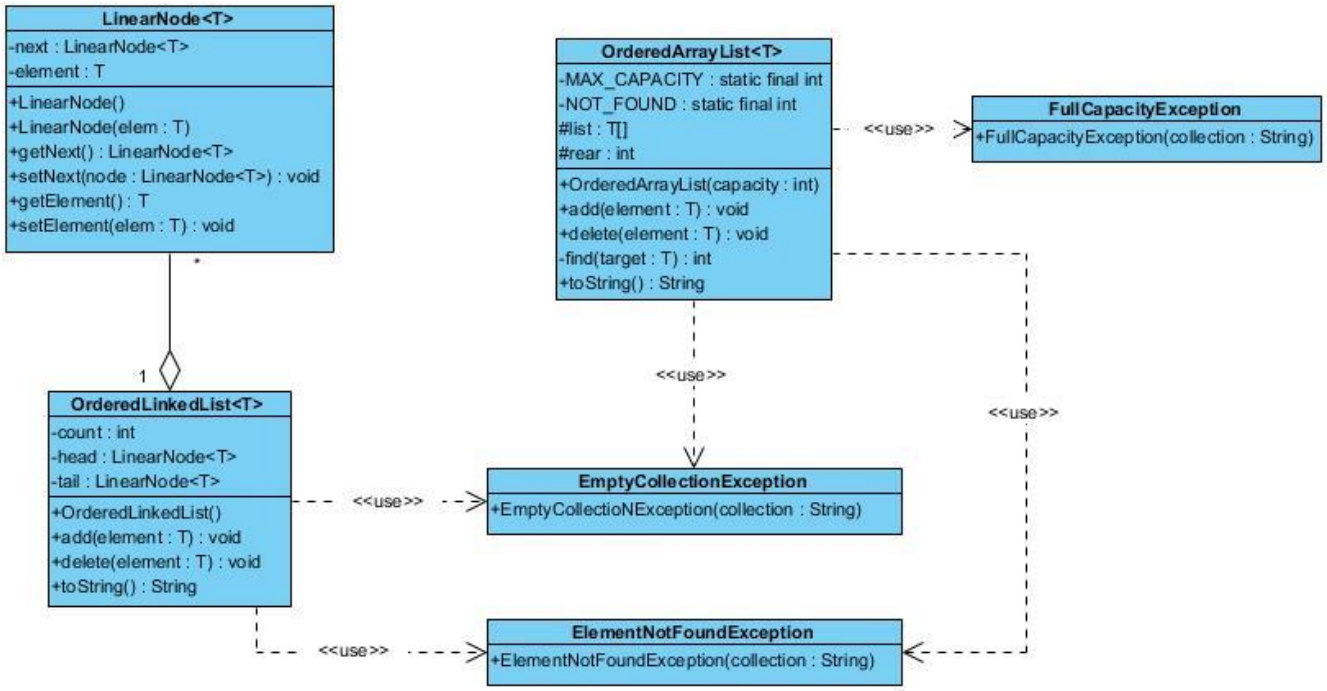
COMP 2230 – Data Structures and Algorithm Analysis

Assignment #6: Lists

Due Date: S01 October. 24th S02 October 25th

Chapter 15



Problem #1 Code

OrderedArrayList.java

```
package Ass6_2230;

import Ass6_2230.Exceptions.*;

import java.lang.reflect.Array;
import java.util.Arrays;
import java.util.*;

/**
 * ArrayOrderedList represents an array implementation of an ordered list.
 *
```

```
 * @author Colton Isles, Kaylee Crocker
 */
public class OrderedArrayList<T extends Comparable<T>> {

    private static final int MAX_CAPACITY = 10;
    private final static int NOT_FOUND = -1;

    protected T[] list;
    protected int rear;

    /**
     * Constructs the OrderedListArray with the maximum capacity
     * of 10.
     */
     public OrderedArrayList() {
         this(MAX_CAPACITY);
        }

    /**
     * Constructs the OrderedListArray with specified capacity
     * sets capacity to 10 if it is over the maximum.
     *
     * @param capacity Capacity of the arrayList with maximum of 10
     */
    OrderedArrayList(int capacity) {
            if (capacity >= MAX_CAPACITY) {
                list = (T[]) Array.newInstance(Comparable.class,
MAX_CAPACITY);
            } else {
                list = (T[]) Array.newInstance(Comparable.class, capacity);
            }
            rear = 0;
        }

    /**
     * Adds the element to it's place in the list.
     * @param element element to be added
     */
    public void add(T element) {

            int index = 0;
            if(rear == MAX_CAPACITY){
                throw new FullCapacityException("list");
            }
            while (index < rear && element.compareTo(list[index]) > 0) {
                index++;
            }
```

```
            for (int i = rear; i > index; i--) {
                list[i] = list[i - 1];
            }

            list[index] = element;
            rear++;
        }

    /**
     * Deletes the element if it is in the list.
     * @param element element to delete
     */
    public void delete(T element) {

        int index = find(element);
        list[index] = null;

        for (int i = index; i < rear - 1; i++) {
            list[i] = list[i + 1];
        }
        rear--;
        list[rear] = null;
    }

    /**
     * Finds the index of the target in the list.
     * @param target element to search for
     * @return result of the search
     */
    private int find(T target) throws ElementNotFoundException {

        int result = NOT_FOUND;

        for (int index = 0; index < rear; index++) {
            if (list[index].equals(target)) {
                result = index;
                break;
            } else if (index == rear - 1 || list[index].compareTo(target) >
0) {
                throw new ElementNotFoundException("list");
            }
        }
        return result;
    }

    /**
     * Returns a string of items in the list.
     * @return string of list items
```

```
     */
    @Override
    public String toString() {
        return Arrays.toString(list);
        }
}
```

OrderedArrayList.java

```
package Ass6_2230;

import Ass6_2230.Exceptions.*;

public class OrderedArrayListTest {
    public static void main(String[] args) {
        // Create new list
        OrderedArrayList<Integer> list = new OrderedArrayList<Integer>();


        System.out.println("Testing sorted add method:");
        System.out.println("--------------------------");

        System.out.println(list.toString());
        list.add(2);
        System.out.println(list.toString());
        list.add(9);
        System.out.println(list.toString());
        list.add(1);
        System.out.println(list.toString());
        list.add(6);
        System.out.println(list.toString());
        list.add(8);
        System.out.println(list.toString());
        list.add(4);
        System.out.println(list.toString());
        list.add(3);
        System.out.println(list.toString());
        list.add(5);
        System.out.println(list.toString());
        list.add(7);
        System.out.println(list.toString());
        list.add(0);
        System.out.println(list.toString());
        /*list.add(10);
        System.out.println(list.toString());*/

        System.out.println("Testing delete method:");
```

```
        System.out.println("-------------------------");
        System.out.println(list.toString());
        list.delete(6);
        System.out.println(list.toString());
        list.delete(1);
        System.out.println(list.toString());
        list.delete(9);
        System.out.println(list.toString());
        System.out.println("Trying to delete absent element:");
        System.out.println("-------------------------");
        try {
            list.delete(11);
        } catch (ElementNotFoundException e) {
            System.out.println("Throws ElementNotFoundException
correctly.");
        }
    }
}
```

Problem #1 Output

```
"C:\Program Files\Java\jdk-20\bin\java.exe" "-javaagent:C:\Program Fil
Testing sorted add method:
--------------------------
[null, null, null, null, null, null, null, null, null, null]
[2, null, null, null, null, null, null, null, null, null]
[2, 9, null, null, null, null, null, null, null, null]
[1, 2, 9, null, null, null, null, null, null, null]
[1, 2, 6, 9, null, null, null, null, null, null]
[1, 2, 6, 8, 9, null, null, null, null, null]
[1, 2, 4, 6, 8, 9, null, null, null, null]
[1, 2, 3, 4, 6, 8, 9, null, null, null]
[1, 2, 3, 4, 5, 6, 8, 9, null, null]
[1, 2, 3, 4, 5, 6, 7, 8, 9, null]
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
Testing delete method:
--------------------------
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
[0, 1, 2, 3, 4, 5, 7, 8, 9, null]
[0, 2, 3, 4, 5, 7, 8, 9, null, null]
[0, 2, 3, 4, 5, 7, 8, null, null, null]
Trying to delete absent element:
--------------------------
Throws ElementNotFoundException correctly.

Process finished with exit code 0
```

Problem #2 Code

OrderedLinkedList.java

```
package Ass6_2230;

import Ass6_2230.Exceptions.*;

public class OrderedLinkedList<T extends Comparable<T>> {
    private int count;
    private LinearNode<T> head;

    public OrderedLinkedList(){
```

```
        count = 0;
        head = null;

    }

    /**
     * Adds an element to its place in the list.
     * @param element element to add
     */
    public void add(T element){
        LinearNode<T> node = new LinearNode<T>(element);
        if(head == null){
            head = node;
            count++;
            return;
        }

        if(element.compareTo(head.getElement()) <= 0){
            node.setNext(head);
            head = node;
            count++;
            return;
        }

        LinearNode<T> current = head;
        while(current.getNext() != null &&
element.compareTo(current.getNext().getElement()) > 0){
            current = current.getNext();
        }

        node.setNext(current.getNext());
        current.setNext(node);

        count++;

    }

    /**
     * Deletes an element from the list.
     * @param element element to delete
     * @throws EmptyCollectionException
     * @throws ElementNotFoundException
     */
    public void delete(T element) throws EmptyCollectionException,
ElementNotFoundException {
         LinearNode<T> current = head;

         if(head == null){
```

```
            throw new EmptyCollectionException("LinkedList");
        }
        if(head.getElement().equals(element)){
            head = head.getNext();
            count--;
            return;
        }

        for (int i = 0; i < count; i++) {
            if (current.getNext() == null ||
current.getNext().getElement().compareTo(element) > 0) {
                throw new ElementNotFoundException("Arraylist");
            } else if (current.getNext().getElement().equals(element)) {
                current.setNext(current.getNext().getNext());
                count--;
                return;
            }
            current = current.getNext();
        }

    }

    /**
     * Returns a string of items in the list.
     * @return string of list items
     */
    public String toString(){
        if(count == 0){
            return "Empty List";
        }
        StringBuilder result = new StringBuilder();
        LinearNode<T> current = head;
        for (int i = 1; i <= count; i++) {
            result.append(current.getElement()).append(", ");
            current = current.getNext();
        }
        result.deleteCharAt(result.length()-2);
        return result.toString();
    }

}
```

OrderedLinkedListTest.java

```
package Ass6_2230;

import Ass6_2230.Exceptions.ElementNotFoundException;
```

```
public class OrderedLinkedListTest {
    public static void main(String[] args) {
        // Create new list
        OrderedLinkedList<Integer> list = new OrderedLinkedList<Integer>();

        System.out.println("Testing sorted add method:");
        System.out.println("--------------------------");

        System.out.println(list.toString());
        list.add(2);
        System.out.println(list.toString());
        list.add(9);
        System.out.println(list.toString());
        list.add(1);
        System.out.println(list.toString());
        list.add(6);
        System.out.println(list.toString());
        list.add(8);
        System.out.println(list.toString());
        list.add(4);
        System.out.println(list.toString());
        list.add(3);
        System.out.println(list.toString());
        list.add(5);

        System.out.println("Testing delete method:");
        System.out.println("--------------------------");
        System.out.println(list.toString());
        list.delete(6);
        System.out.println(list.toString());
        list.delete(1);
        System.out.println(list.toString());
        list.delete(9);
        System.out.println(list.toString());
        System.out.println("Trying to delete absent element:");
        System.out.println("--------------------------");
        try {
            list.delete(11);
        } catch (ElementNotFoundException e) {
            System.out.println("Throws ElementNotFoundException
correctly.");
        }

    }

}
```

Problem #2 Output

```
"C:\Program Files\Java\jdk-20\bin\java.exe" "-jav
Testing sorted add method:
--------------------------
Empty List
2
2, 9
1, 2, 9
1, 2, 6, 9
1, 2, 6, 8, 9
1, 2, 4, 6, 8, 9
1, 2, 3, 4, 6, 8, 9
Testing delete method:
--------------------------
1, 2, 3, 4, 5, 6, 8, 9
1, 2, 3, 4, 5, 8, 9
2, 3, 4, 5, 8, 9
2, 3, 4, 5, 8
Trying to delete absent element:
--------------------------
Throws ElementNotFoundException correctly.

Process finished with exit code 0
```