Data Structures and Algorithms
BS (CS/SE)
Lab #02

Submission mode: E-Learning   **Instructor:** Irum Sindhu

Lab Task: Linked List Implementation

In this lab, you will implement a LinkedList class in Java. The class must implement the given List interface. Through this exercise, you will practice insertion, deletion, traversal, searching, duplication operations on a linked list.

Tasks

Task 1: Node Class
Write a Node class with the following fields:
- Object data
- Node next (pointer to the next node)
Test by creating 3 nodes and linking them manually.

Task 2: Implement List Interface
Write a class called LinkedList that implements the following List interface:

```
public interface List {
 public boolean isEmpty();
 public int size();
 public void add(Object item);
 public void add(int index, Object item);
 public void remove(int index);
 public void remove(Object item);
 public List duplicate();
}
```

Task 3: Insertion Operations
Implement methods in LinkedList:

- add(Object item): Insert at the beginning
- add(Object item): Insert at the end
- add(int index, Object item): Insert at a specific index

```
// a list interface public
interface List {

    public boolean isEmpty();
    // returns true if the list is empty, false otherwise


    public int size();
    // returns the number of items in the list


    public void add(Object item);
    // adds an item to the list
    // item is added at the end of the list


    public void add(int index, Object item);
    // adds an item to the list at the given index
    // item is added at the given index;
    // the indices start from 1.


    public void remove(int index);
    // removes the item from the list that has the given index


    public void remove(Object item);
    // removes an item from the list
    // removes the first item in the list whose equal method matches
    // that of the given item


    public List duplicate();
    // creates a duplicate of the list
    // returns a copy of the linked list
```

Task 4: Deletion Operations
Implement methods in LinkedList:

- remove(): Remove the element at the beginning
- remove(int index): Remove the element at the given index
- remove(): Remove the element at the end

Task 5: Traversal and Display

Write methods to:
- Print all elements in the list
- Search for a specific element (return true/false)

Task 6: Advanced Operations

Implement methods:
- duplicate(): Return a copy of the linked list

Deliverables

Students must submit:
- Java code for all tasks
- Screenshots of outputs for each operation