Merit-Quality-Excellence

Sukkur IBA University

Data Structures

LAB No: 02

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Objective of Lab No. 2:

After performing lab2, students will be able to:

- Implementation of Linked list

Practice 02

We have already covered Linked List. Some of the basic operation of linked list are following

a) Create linked list
b) Implementation of Insert, show, isEmpty and delete operation

```
class Node{
    int data;
    Node next;

    //Constructor
    Node(int data)
    {
        this.data=data;
        this.next=null;

    }
}
class LinkedList{

    Node head;
    void addToBack(int data)
    {
        Node node=new Node(data);

        if(head==null)
            head=node;
        else{
            Node n=head;
            while(n.next!=null)
                n=n.next;
            n.next=node;
        }
    }
    void printList() {
        Node = head;
        while (node.next != null){
            System.out.print(node.data + " ");
```

```
            node = node.next;
        }
        System.out.print(node.data + " ");
    }
        void addToFront(int data)
        {
            Node =new Node(data);

            node.next=head;
            head=node;

        }

    void addMiddle(int index,int data)
    {
        Node =new Node(data);
        node.data=data;
        node.next=null;
        Node n=head;
        for(int i=1;i<index-1;i++)
        {
            n=n.next;
        }
        node.next=n.next;
        n.next=node;
    }
    void removeFromFront()
    {
       head=head.next;

    }
    void removeFromBack()
    {
        Node n=head;
        while(n.next.next!=null)
            n=n.next;
        n.next=null;
    }
    void removeAt(int index)
    {
    if (index==1)
        removeFromFront();
    }
    else{
        Node n=head;
        Node temp=null;
        for(int i=1;i<index-1;i++)
        {
            n=n.next;
        }
        temp=n.next;
        n.next=temp.next;
    }
    boolean isEmpty(){
    return head == null;
    }
```

```
}

public class Main {
    public static void main(String[] args) {
        LinkedList ll=new LinkedList();
        ll.addToBack(5);
        ll.addToBack(19);
        /*
        ll.addLast(19);
        ll.show();
        System.out.println("");
        ll.addStart(20);
        ll.show();

        System.out.println("");
        ll.addMiddle(2,200);
        ll.show();

        System.out.println("");
        ll.deleteStart();
        ll.show();
    */
    }

}
```

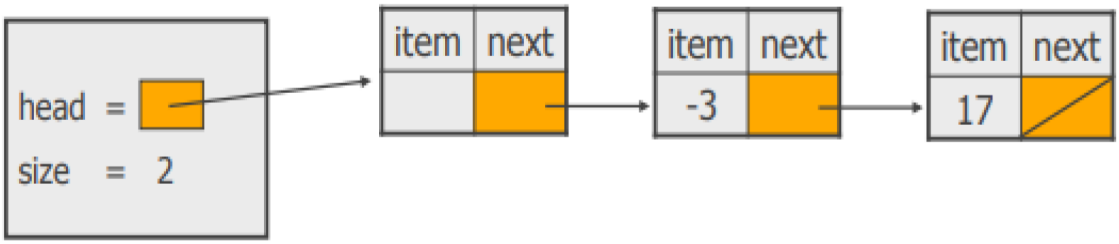
Exercise

1. Implement a function **search(int data)** to search for a specific element in a linked list.

2. Write a function **getSize()** to find the length of a linked list.

3. In this task you will write a program that implements a variant of a linked list. This variant has a dummy node pointed to by the head link as shown in the following figure:

Linked list with a dummy first node:



This trick will allow your code to be a little simpler, not requiring a special case for add or remove operations. Your constructor method will be:

```
public LinkedList(){
    head = new Node(null);
    size = 0;
}
```

You need to write a class called LinkedList that implements the following List interface:

```
// 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 addToBack(Object item);
    // adds an item to the list
    // item is added at the end of the list

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

```
    public void removeFromFront(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

    public List duplicateReversed();
    // creates a duplicate of the list with the nodes in reverse order
    // returns a copy of the linked list with the nodes in reverse order
}
```

In addition to the interface, your LinkedList class needs to implement a toString() method that prints the list in the format

[size: the_size_of_the_list - item1, item2, ...]

Note: Your Node class should be an inner class within the LinkedList class. **Make sure your** class **implements the** interface **as specified, i.e. your** class **should begin with** public class LinkedList implements List**.**