**1.Doubly Linked List Insertion in java**

class Abhi{

Node head;

Node tail;

static class Node {

int data;

Node prev;

Node next;

Node(int d) {

data = d;

prev = null;

next = null;

}

}

public void insertBeginning(int data) {

Node newNode = new Node(data);

if (head == null) {

head = newNode;

tail = newNode;

} else {

newNode.next = head;

head.prev = newNode;

head = newNode;

}

}

public void insertEnd(int data) {

Node newNode = new Node(data);

if (head == null) {

head = newNode;

tail = newNode;

} else {

tail.next = newNode;

newNode.prev = tail;

tail = newNode;

}

}

// Method to insert a node at a given position

public void insertAtPosition(int data, int position) {

if (position < 0)

throw new IllegalArgumentException("Position cannot be negative");

Node newNode = new Node(data);

if (position == 0) {

newNode.next = head;

if (head != null)

head.prev = newNode;

head = newNode;

return;

}

Node current = head;

int currentPosition = 0;

while (currentPosition < position - 1 && current != null) {

current = current.next;

currentPosition++;

}

if (current == null && currentPosition < position - 1) {

throw new IllegalArgumentException("Position exceeds the length of the list");

}

newNode.next = current.next;

if (current.next != null)

current.next.prev = newNode;

current.next = newNode;

newNode.prev = current;

}

public void display() {

Node current = head;

while (current != null) {

System.out.print(current.data + " ");

current = current.next;

}

System.out.println();

}

public static void main(String[] args) {

Abhi dll = new Abhi ();

System.out.println("Insert at beggining :");

dll.insertBeginning(1);

dll.insertBeginning(2);

dll.insertBeginning(3);

dll.display();

System.out.println("Insert at end :");

dll.insertEnd(4);

dll.insertEnd(5);

dll.insertEnd(6);

dll.display();

dll.insertAtPosition(4,3);

System.out.println("after insert 4 at position 3 :");

dll.display();

}

}

===================================================================================

**2.Reverse a Doubly Linked List in java**

class Abhi {

Node head;

//creating node

static class Node {

int data;

Node prev; //prev node reference

Node next;

Node(int d) {

data = d;

prev = null;

next = null;

}

}

// Function to reverse a doubly linked list

void reverse() {

Node temp = null;

Node current = head;

// Swap next and prev for all nodes of

// doubly linked list

while (current != null) {

temp = current.prev;

current.prev = current.next;

current.next = temp;

current = current.prev;

}

// Before changing head, check empty list

if (temp != null) {

head = temp.prev;

}

}

// Function to print nodes in a given doubly linked list

void printList(Node node) {

while (node != null) {

System.out.print(node.data + " ");

node = node.next;

}

}

// Function to insert a node at the beginning of the doubly linked list

void push(int new\_data) {

// Allocate node

Node new\_node = new Node(new\_data);

// Make next of new node as head and previous as NULL

new\_node.next = head;

new\_node.prev = null;

// Change prev of head node to new node

if (head != null)

head.prev = new\_node;

// Move the head to point to the new node

head = new\_node;

}

public static void main(String[] args) {

Abhi list = new Abhi();

list.push(1);

list.push(4);

list.push(5);

list.push(3);

list.push(8);

System.out.println("Original linked list:");

list.printList(list.head);

list.reverse();

System.out.println("\nReversed linked list:");

list.printList(list.head);

}

}

**====================================================================================**

**3.Delete a node in a Doubly Linked List in java**

class Abhi {

Node head;

//creating node

static class Node {

int data;

Node prev; //prev node reference

Node next;

Node(int d) {

data = d;

prev = null;

next = null;

}

}

void deleteNode(Node del){

if (head == null || del == null) {

return;

}

// If node to be deleted is head node

if (head == del) {

head = del.next;

}

// Change next only if node to be deleted is NOT the last node

if (del.next != null) {

del.next.prev = del.prev;

}

// Change prev only if node to be deleted is NOT the first node

if (del.prev != null) {

del.prev.next = del.next;

}

}

// Function to print nodes in a given doubly linked list

void printList(Node node) {

while (node != null) {

System.out.print(node.data + " ");

node = node.next;

}

}

// Function to insert a node at the beginning of the doubly linked list

void insert(int new\_data) {

// Allocate node

Node new\_node = new Node(new\_data);

// Make next of new node as head and previous as NULL

new\_node.next = head;

new\_node.prev = null;

// Change prev of head node to new node

if (head != null)

head.prev = new\_node;

// Move the head to point to the new node

head = new\_node;

}

public static void main(String[] args) {

Abhi list = new Abhi();

list.insert(1);

list.insert(4);

list.insert(5);

list.insert(3);

list.insert(8);

System.out.println("Original linked list:");

list.printList(list.head);

// Delete node with value 5

Node delNode = list.head.next.next; // Node with value 5

list.deleteNode(delNode);

System.out.println("\nLinked list after deleting node with value 5:");

list.printList(list.head);

}

}

**=====================================================================================**

**4.Program to find length of Doubly Linked List in java**

class Abhi {

Node head;

//creating node

static class Node {

int data;

Node prev; //prev node reference

Node next;

Node(int d) {

data = d;

prev = null;

next = null;

}

}

int length() {

int count = 0;

Node current = head;

while (current != null) {

count++;

current = current.next;

}

return count;

}

// Function to print nodes in a given doubly linked list

void printList(Node node) {

while (node != null) {

System.out.print(node.data + " ");

node = node.next;

}

}

// Function to insert a node at the beginning of the doubly linked list

void insert(int new\_data) {

// Allocate node

Node new\_node = new Node(new\_data);

// Make next of new node as head and previous as NULL

new\_node.next = head;

new\_node.prev = null;

// Change prev of head node to new node

if (head != null)

head.prev = new\_node;

// Move the head to point to the new node

head = new\_node;

}

public static void main(String[] args) {

Abhi list = new Abhi();

list.insert(1);

list.insert(4);

list.insert(5);

list.insert(3);

list.insert(8);

System.out.println("Length of the linked list: " + list.length());

}

}

**=====================================================================================**

**5.Find the largest node in Doubly linked list in java**

class Abhi {

Node head;

//creating node

static class Node {

int data;

Node prev; //prev node reference

Node next;

Node(int d) {

data = d;

prev = null;

next = null;

}

}

int findLargest() {

if (head == null) {

return Integer.MIN\_VALUE; // Return minimum value if the list is empty

}

int max = head.data;

Node current = head.next;

// Iterate through the list and update the max value

while (current != null) {

if (current.data > max) {

max = current.data;

}

current = current.next;

}

return max;

}

// Function to print nodes in a given doubly linked list

void printList(Node node) {

while (node != null) {

System.out.print(node.data + " ");

node = node.next;

}

}

// Function to insert a node at the beginning of the doubly linked list

void insert(int new\_data) {

// Allocate node

Node new\_node = new Node(new\_data);

// Make next of new node as head and previous as NULL

new\_node.next = head;

new\_node.prev = null;

// Change prev of head node to new node

if (head != null)

head.prev = new\_node;

// Move the head to point to the new node

head = new\_node;

}

public static void main(String[] args) {

Abhi list = new Abhi();

list.insert(1);

list.insert(4);

list.insert(5);

list.insert(3);

list.insert(8);

int largest = list.findLargest();

if (largest != Integer.MIN\_VALUE) {

System.out.println("Largest element in the linked list: " + largest);

} else {

System.out.println("The linked list is empty.");

}

}

}

**=====================================================================================**

**6.Insert value in sorted way in a sorted doubly linked list in java**

class Abhi {

Node head;

class Node {

int data;

Node prev;

Node next;

Node(int d) {

data = d;

prev = null;

next = null;

}

}

// Function to insert a node with given data in sorted way

void sortedInsert(int new\_data) {

Node new\_node = new Node(new\_data);

Node current;

// If list is empty or new node is to be inserted before the head node

if (head == null || head.data >= new\_node.data) {

new\_node.next = head;

new\_node.prev = null;

if (head != null)

head.prev = new\_node;

head = new\_node;

return;

}

// Find the node after which new node to be inserted

current = head;

while (current.next != null && current.next.data < new\_node.data)

current = current.next;

// Insert the new\_node after current

new\_node.next = current.next;

if (current.next != null)

current.next.prev = new\_node;

current.next = new\_node;

new\_node.prev = current;

}

// Function to print nodes in a given doubly linked list

void printList(Node node) {

while (node != null) {

System.out.print(node.data + " ");

node = node.next;

}

}

public static void main(String[] args) {

Abhi list = new Abhi ();

// Insert 10, 20, 30, 40, 50 in sorted order

list.sortedInsert(40);

list.sortedInsert(10);

list.sortedInsert(30);

list.sortedInsert(50);

list.sortedInsert(20);

System.out.println("Sorted Doubly Linked List:");

list.printList(list.head);

}

}

**=====================================================================================**

**7.Write tree traversals in java**

class Abhi\_BinaryTree {

Node root;

// Node class representing a node in the binary tree

static class Node {

int data;

Node left, right;

public Node(int item) {

data = item;

left = right = null;

}

}

public Abhi\_BinaryTree() {

root = null;

}

// Inorder traversal: Left -> Root -> Right

public void inorderTraversal(Node node) {

if (node == null)

return;

inorderTraversal(node.left);

System.out.print(node.data + " ");

inorderTraversal(node.right);

}

// Preorder traversal: Root -> Left -> Right

public void preorderTraversal(Node node) {

if (node == null)

return;

System.out.print(node.data + " ");

preorderTraversal(node.left);

preorderTraversal(node.right);

}

// Postorder traversal: Left -> Right -> Root

public void postorderTraversal(Node node) {

if (node == null)

return;

postorderTraversal(node.left);

postorderTraversal(node.right);

System.out.print(node.data + " ");

}

// Driver method to test traversal methods

public static void main(String[] args) {

Abhi\_BinaryTree tree = new Abhi\_BinaryTree();

tree.root = new Node(10);

tree.root.left = new Node(20);

tree.root.right = new Node(30);

tree.root.left.left = new Node(40);

tree.root.left.right = new Node(50);

System.out.println("Inorder traversal:");

tree.inorderTraversal(tree.root);

System.out.println("\nPreorder traversal:");

tree.preorderTraversal(tree.root);

System.out.println("\nPostorder traversal:");

tree.postorderTraversal(tree.root);

}

}

**=====================================================================================**

**8.Search a node in Binary Tree**

class Abhi\_BinaryTree {

Node root;

// Node class representing a node in the binary tree

static class Node {

int data;

Node left, right;

public Node(int item) {

data = item;

left = right = null;

}

}

public Abhi\_BinaryTree() {

root = null;

}

// Search for a node with given key in the binary tree

public boolean search(Node node, int key) {

// Base Cases: root is null or key is present at root

if (node == null)

return false;

if (node.data == key)

return true;

// Recur for left and right subtrees

return search(node.left, key) || search(node.right, key);

}

public static void main(String[] args) {

Abhi\_BinaryTree tree = new Abhi\_BinaryTree();

tree.root = new Node(10);

tree.root.left = new Node(20);

tree.root.right = new Node(30);

tree.root.left.left = new Node(40);

tree.root.left.right = new Node(50);

int key = 40;

if (tree.search(tree.root, key))

System.out.println( key + " found in the tree");

else

System.out.println( key + " not found in the tree");

}

}

**=====================================================================================**

**9.Inorder Successor of a node in Binary Tree**

class Abhi\_BinaryTree {

Node root;

// Node class representing a node in the binary tree

static class Node {

int data;

Node left, right;

public Node(int item) {

data = item;

left = right = null;

}

}

public Abhi\_BinaryTree() {

root = null;

}

// Function to find the leftmost node in the subtree rooted at given node

public Node findLeftmostNode(Node node) {

if (node == null)

return null;

while (node.left != null)

node = node.left;

return node;

}

// Function to find the inorder successor of a given node

public Node inorderSuccessor(Node root, Node node) {

// If right subtree of node is not null, then the inorder successor

// is the leftmost node in the right subtree

if (node.right != null)

return findLeftmostNode(node.right);

// Otherwise, we need to find the ancestor of the node for which

// the given node is in the left subtree

Node successor = null;

Node current = root;

while (current != null) {

if (node.data < current.data) {

successor = current;

current = current.left;

} else if (node.data > current.data) {

current = current.right;

} else {

break; // Node found, exit loop

}

}

return successor;

}

public static void main(String[] args) {

Abhi\_BinaryTree tree = new Abhi\_BinaryTree();

tree.root = new Node(10);

tree.root.left = new Node(20);

tree.root.right = new Node(30);

tree.root.left.left = new Node(40);

tree.root.left.right = new Node(50);

Node node = tree.root.left.right; // Node for which we want to find the successor

Node successor = tree.inorderSuccessor(tree.root, node);

if (successor != null)

System.out.println("Inorder successor of " + node.data + " is " + successor.data);

else

System.out.println("No inorder successor found for " + node.data);

}

}

**=====================================================================================**

**10.Print Head node of every node in Binary Tree**

class Abhi\_BinaryTree {

Node root;

// Node class representing a node in the binary tree

static class Node {

int data;

Node left, right;

public Node(int item) {

data = item;

left = right = null;

}

}

public Abhi\_BinaryTree() {

root = null;

}

// Function to find the head node

public Node findHeadNode(Node root, Node node) {

if (root == null || root == node) {

return root;

}

Node left = findHeadNode(root.left, node);

Node right = findHeadNode(root.right, node);

// If the node is found in the left subtree, return the root of the left subtree

if (left != null) {

return left;

}

// If the node is found in the right subtree, return the root of the right subtree

if (right != null) {

return right;

}

// Otherwise, the node is not found in the current subtree

return null;

}

// Function to print the head node

public void printHeadNodes(Node root) {

if (root == null) {

return;

}

// Traverse each node and print its head node

printHeadNodes(root.left);

System.out.println("Head node of " + root.data + " is " + findHeadNode(this.root, root).data);

printHeadNodes(root.right);

}

public static void main(String[] args) {

Abhi\_BinaryTree tree = new Abhi\_BinaryTree();

tree.root = new Node(10);

tree.root.left = new Node(20);

tree.root.right = new Node(30);

tree.root.left.left = new Node(40);

tree.root.left.right = new Node(50);

tree.printHeadNodes(tree.root);

}

}

**=====================================================================================**