Data Structures and Algorithms
Lab Assignment 3

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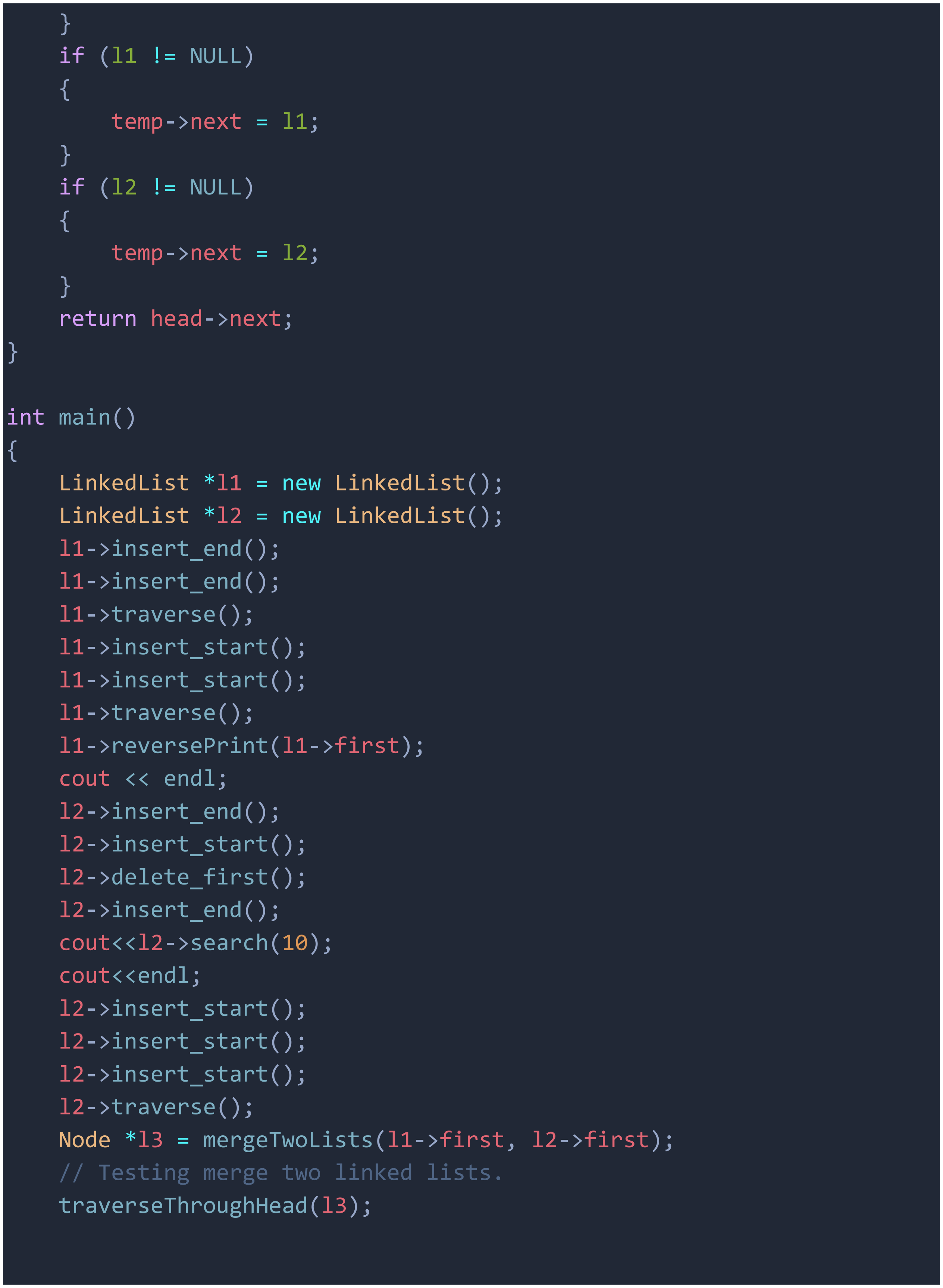
Linked List and All its vital methods.

Code:

```
 #include <iostream>
#include <list>
using namespace std;

struct Node
{
    int data;
    Node *next = nullptr;
};

class LinkedList
{
public:
    Node *first = nullptr;
    Node *last = nullptr;

    LinkedList()
    {
        first = nullptr;
    }

    void insert_end()
    {

        Node *p;

        p = new Node;
        cout << "Enter the data in node:";
        cin >> p->data;

        if (first == NULL)

            first = last = p;
        else
        {
            last->next = p;
            last = p; /* assign p to last node */
        }
    }
    void insert_start()
    {
        // take the pointer to hold the address of nodetype record
        Node *p;
        // allocate runtime memory for new record of nodetype using
new operator
        p = new Node;
        cout << "Enter the data in node:";
        cin >> p->data;
        if (first == NULL) /* l i s t i s empty */
                           /* p becomes first node and first and last
pointer will point to same node */
            first = last = p;
        else
        {
            p->next = first; /* link the new node with first node */
            first = p;       /* assign p to last node */
        }
    }

    Node *search(int key)
    {
        Node *p = first;
        // p = first;
        while (p != NULL && p->data != key)
        {
            p = p->next;
        }
        return p; /* if p is NULL then value not found */
    }

    void insert_after(int key)
    {
        Node *p = NULL;
        p = search(key);
        if (p == NULL)
```

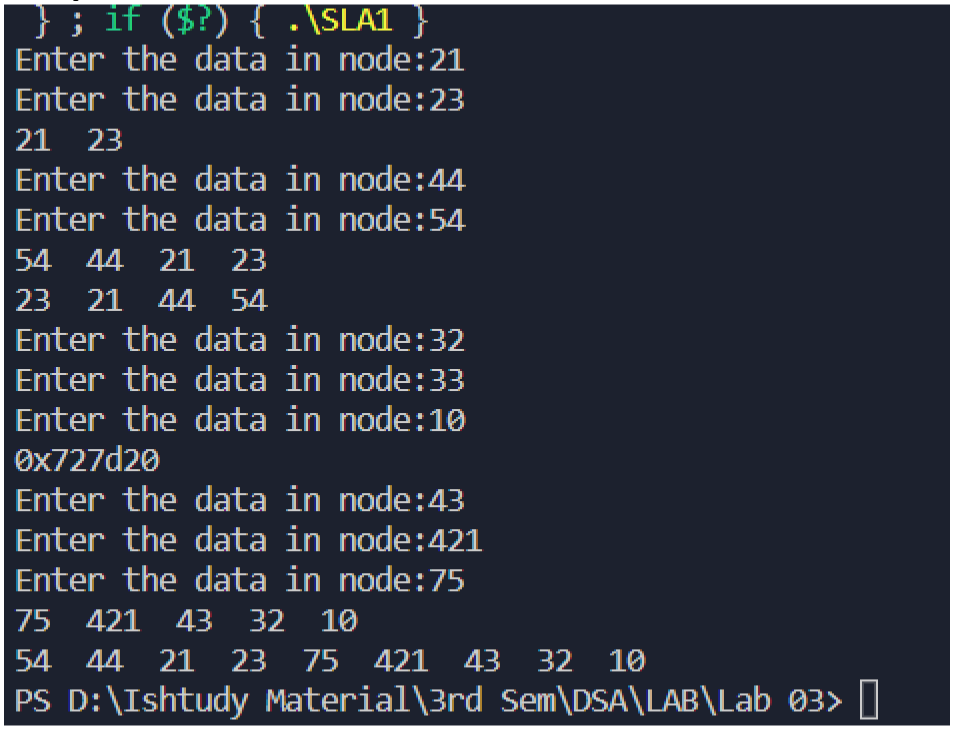
```
            cout << "value not found";
        else
        {
            Node *Newnode;
            Newnode = new Node;
            if (p == last)
            {
                last->next = p;
                last = p;
            }
            else
            {
                Newnode->next = p->next;
                p->next = Newnode;
            }
            cout << "New node linked successfully";
        }
    }
    void delete_first()
    {
        Node *p;
        if (first == nullptr)
            cout << "\n Linked List is empty";
        else
        { /* non-empty l i s t */
            p = first;
            first = first->next;
            delete (p); /* free up memory */
        }
    }

    void delete_last()
    {
        Node *q, *q1;
        q1 = nullptr;
        q = first;
        if (q == nullptr)
        {
            cout << "\n Linked List is empty";
```

```cpp
    }
    else
    {
        while (q != last)
        {           /* advance towards end */
            q1 = q; /*q1 will follow the q pointer */
            q = q->next;
        }
        if (q == first)
        {
            first = last = nullptr;
        }
        else
        { /* more than one node */
            q1->next = nullptr;
            last = q1;
        }
        delete q;
    }
}
void remove_spec(int key)
{
    Node *q, *q1;
    q1 = NULL; /* i n i t i a l i z e */
    q = first;
    /* search node */
    while (q != NULL && q->data != key)
    {
        q1 = q;
        q = q->next;
    }
    if (q == NULL)
    {
        cout << "Not found supplied key";
    }
    else if (q == first && q == last)
    {
        delete q;
        first = last = NULL;
        }
        else if (q == last)
        {
            q1->next = NULL;
            last = q1; /* make 2nd last node as last node */
            delete q;
        }
        else /* other than f i r s t node and last */
        {
            q1->next = q->next;
            delete q;
        }
    }

    void traverse()
    {
        Node *newNode = first;
        while (newNode != nullptr)
        {
            cout << newNode->data << "  ";
            newNode = newNode->next;
        }
        cout << endl;
    }
    void reversePrint(Node *p)
    {
        if (p != nullptr)
        {
            reversePrint(p->next);
            cout << p->data << "  ";
        }
    }

    void countOccurence(int key)
    {
        Node *temp = first;
        int count = 0;
        while (temp != NULL)
        {
            if (temp->data == key)
            {
                count++;
            }
            temp = temp->next;
        }
        cout << "Count of " << key << " is " << count << endl;
    }

};

void traverseThroughHead(Node *head)
    {
        Node *temp = head;
        while (temp != NULL)
        {
            cout << temp->data << "  ";
            temp = temp->next;
        }
        cout << endl;
    }

Node *mergeTwoLists(Node *l1, Node *l2)
{
    Node *head = new Node();
    Node *temp = head;
    while (l1 != NULL && l2 != NULL)
    {
        if (l1->data < l2->data)
        {
            temp->next = l1;
            l1 = l1->next;
        }
        else
        {
            temp->next = l2;
            l2 = l2->next;
        }
        temp = temp->next;
```



```cpp
    }
    if (l1 != NULL)
    {
        temp->next = l1;
    }
    if (l2 != NULL)
    {
        temp->next = l2;
    }
    return head->next;
}

int main()
{
    LinkedList *l1 = new LinkedList();
    LinkedList *l2 = new LinkedList();
    l1->insert_end();
    l1->insert_end();
    l1->traverse();
    l1->insert_start();
    l1->insert_start();
    l1->traverse();
    l1->reversePrint(l1->first);
    cout << endl;
    l2->insert_end();
    l2->insert_start();
    l2->delete_first();
    l2->insert_end();
    cout<<l2->search(10);
    cout<<endl;
    l2->insert_start();
    l2->insert_start();
    l2->insert_start();
    l2->traverse();
    Node *l3 = mergeTwoLists(l1->first, l2->first);
    // Testing merge two linked lists.
    traverseThroughHead(l3);
    return 0;
}
```

Output:



```
 } ; if ($?) { .\SLA1 }
Enter the data in node:21
Enter the data in node:23
21  23
Enter the data in node:44
Enter the data in node:54
54  44  21  23
23  21  44  54
Enter the data in node:32
Enter the data in node:33
Enter the data in node:10
0x727d20
Enter the data in node:43
Enter the data in node:421
Enter the data in node:75
75  421  43  32  10
54  44  21  23  75  421  43  32  10
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```
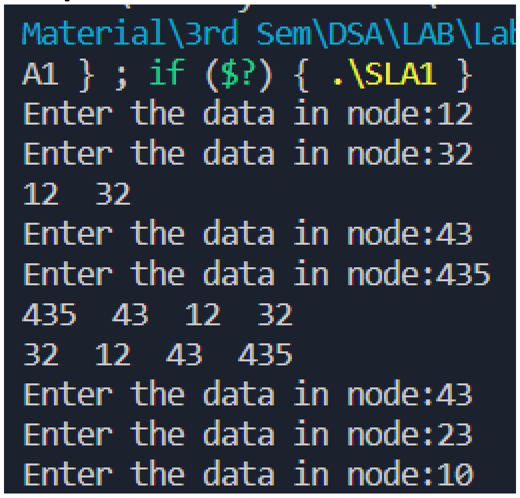

Output 2



```
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A1 } ; if ($?) { .\SLA1 }
Enter the data in node:12
Enter the data in node:32
12  32
Enter the data in node:43
Enter the data in node:435
435  43  12  32
32  12  43  435
Enter the data in node:43
Enter the data in node:23
Enter the data in node:10
```