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19BEC1112

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CSE2003

Data Structures and Algorithms

[LAB]

LAB – 3

Singly Linked Lists

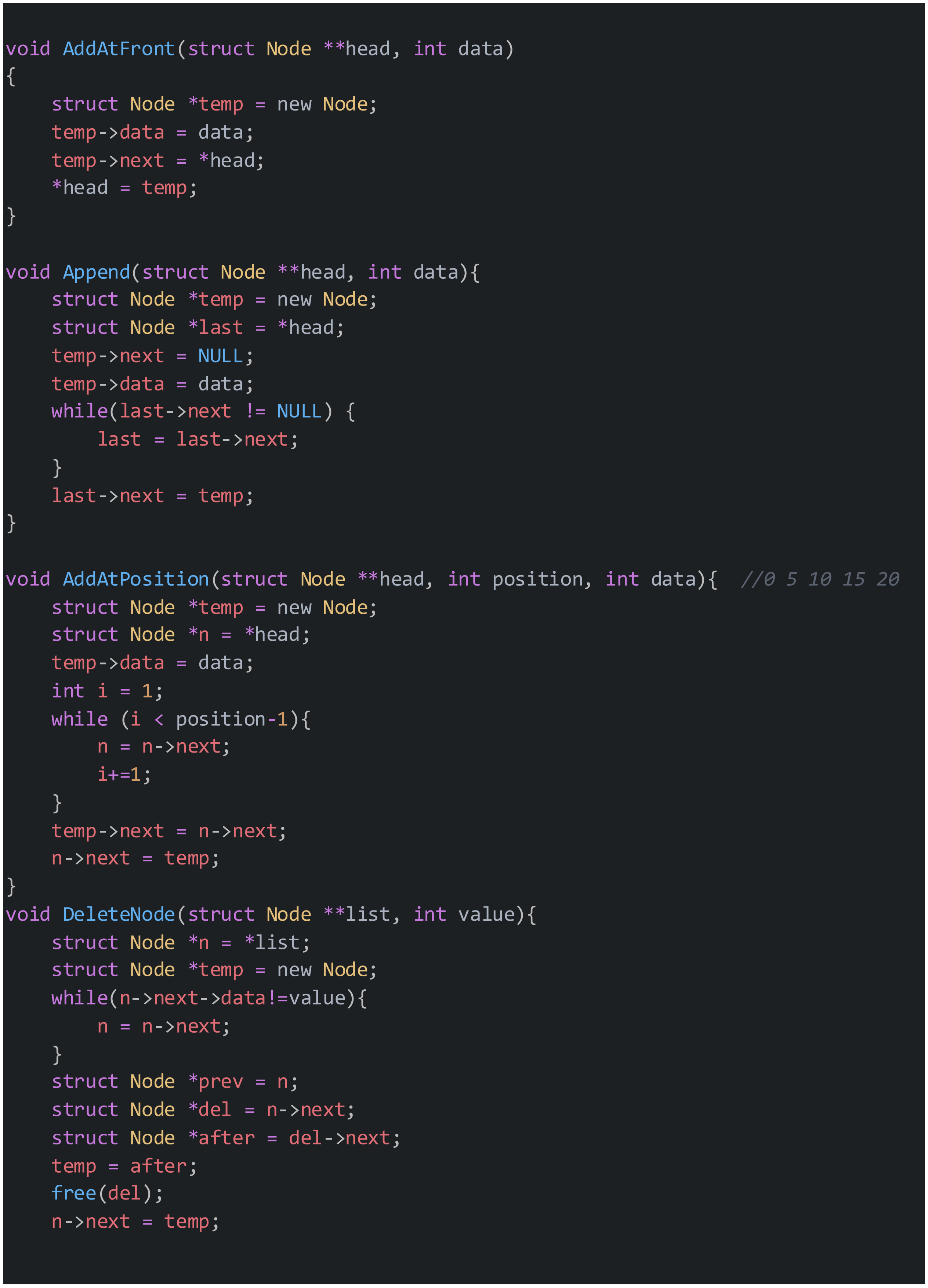
Aim: To learn how to implement singly linked lists and their operations.

Software Required: Code editor (e.g. VS Code, Dev C++), GCC/G++ compiler

Task 1: To create a linear singly linked list and perform create, insert, display, count, and delete operations.

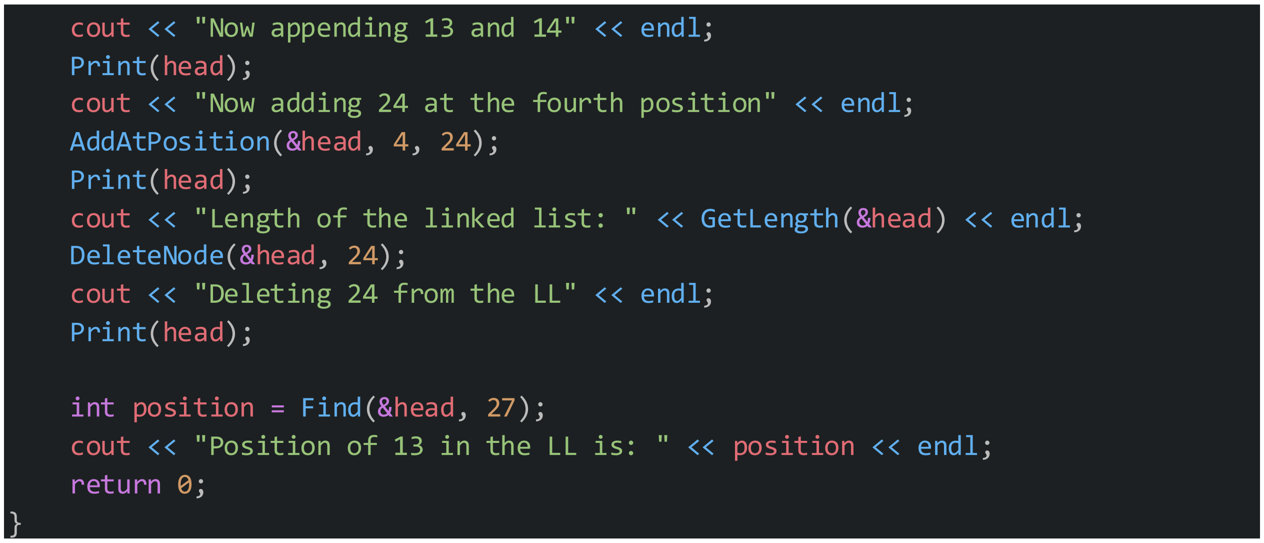
Code:

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

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

void Print(struct Node *n)
{
    while (n != NULL)
    {
        cout << n->data << endl;
        n = n->next;
    }
}
```



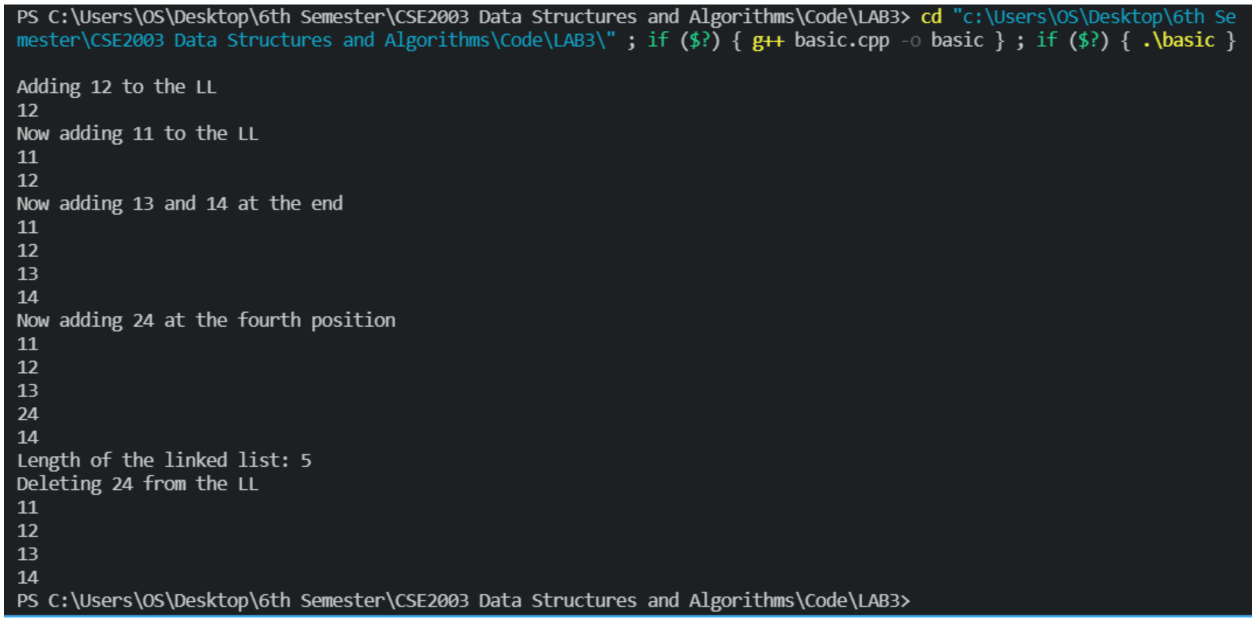
```
void AddAtFront(struct Node **head, int data)
{
    struct Node *temp = new Node;
    temp->data = data;
    temp->next = *head;
    *head = temp;
}

void Append(struct Node **head, int data){
    struct Node *temp = new Node;
    struct Node *last = *head;
    temp->next = NULL;
    temp->data = data;
    while(last->next != NULL) {
        last = last->next;
    }
    last->next = temp;
}

void AddAtPosition(struct Node **head, int position, int data){  //0 5 10 15 20
    struct Node *temp = new Node;
    struct Node *n = *head;
    temp->data = data;
    int i = 1;
    while (i < position-1){
        n = n->next;
        i+=1;
    }
    temp->next = n->next;
    n->next = temp;
}
void DeleteNode(struct Node **list, int value){
    struct Node *n = *list;
    struct Node *temp = new Node;
    while(n->next->data!=value){
        n = n->next;
    }
    struct Node *prev = n;
    struct Node *del = n->next;
    struct Node *after = del->next;
    temp = after;
    free(del);
    n->next = temp;
```

```
}

int GetLength(struct Node **list){
    int length = 0;
    struct Node *n = *list;
    while (n != NULL){
        n = n->next;
        length += 1;
    }
    return length;

}
int Find(struct Node **list, int value){
    struct Node *n = *list;
    int length = GetLength(&n);
    int position = 1;
    while(n->data!=value){
        n = n->next;
        position++;
    }

    if (position==0 || position==length){
        cout << "Element doesn't exist!" << endl;
        return 0;
    }
    else {
        return position;
    }

}
int main()
{

    struct Node *head = new Node;
    head->data = 0;
    head->next = NULL;
    Print(head);
    AddAtFront(&head, 12);
    cout << "Now adding 12" << endl;
    Print(head);
    AddAtFront(&head, 11);
    cout << "Now adding 11" << endl;
    Print(head);
    Append(&head, 13);
    Append(&head, 14);
```



```
    cout << "Now appending 13 and 14" << endl;
    Print(head);
    cout << "Now adding 24 at the fourth position" << endl;
    AddAtPosition(&head, 4, 24);
    Print(head);
    cout << "Length of the linked list: " << GetLength(&head) << endl;
    DeleteNode(&head, 24);
    cout << "Deleting 24 from the LL" << endl;
    Print(head);

    int position = Find(&head, 27);
    cout << "Position of 13 in the LL is: " << position << endl;
    return 0;
}
```

Output:

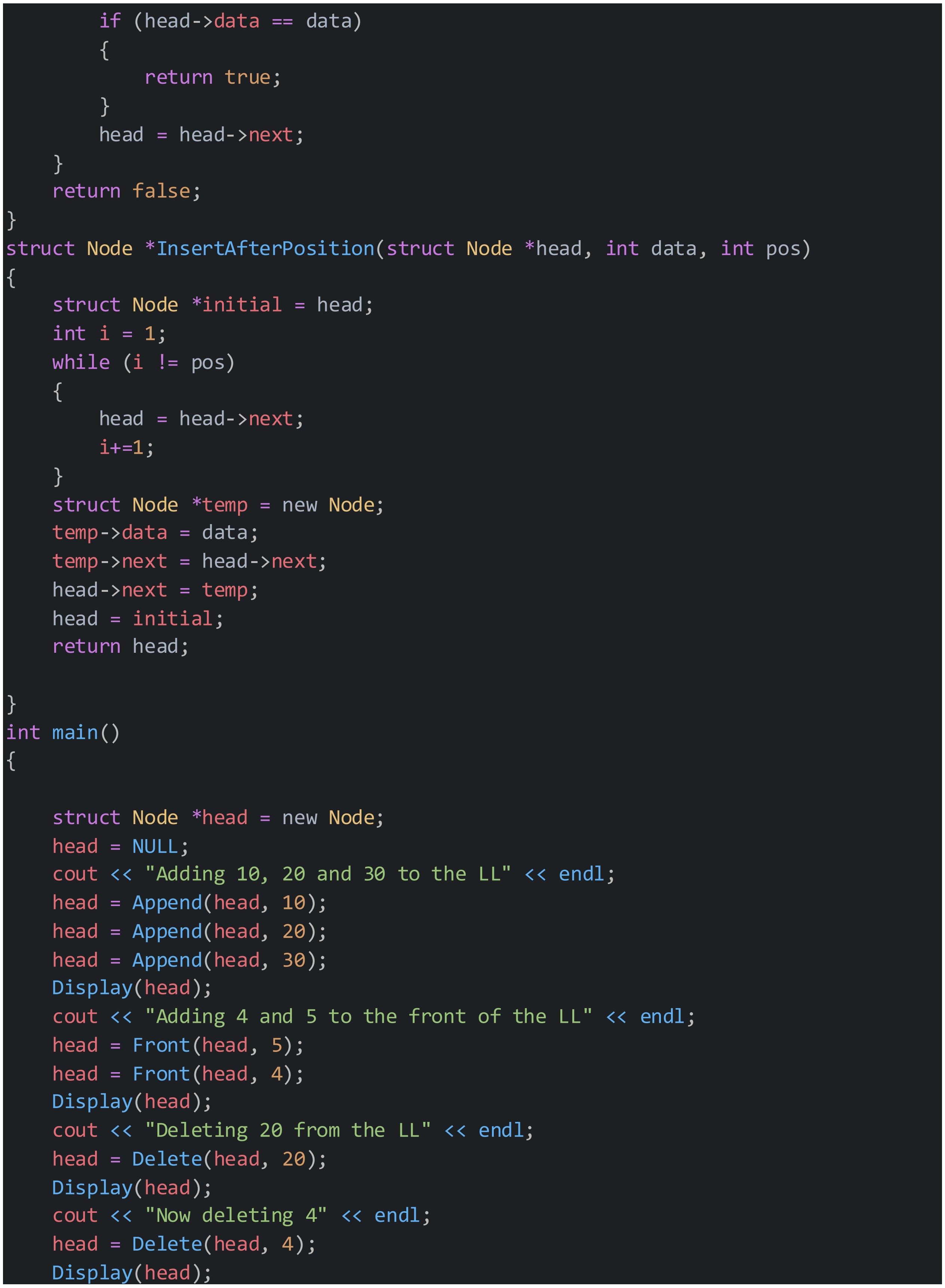


```
PS C:\Users\OS\Desktop\6th Semester\CSE2003 Data Structures and Algorithms\Code\LAB3> cd "c:\Users\OS\Desktop\6th Se
mester\CSE2003 Data Structures and Algorithms\Code\LAB3\" ; if ($?) { g++ basic.cpp -o basic } ; if ($?) { .\basic }

Adding 12 to the LL
12
Now adding 11 to the LL
11
12
Now adding 13 and 14 at the end
11
12
13
14
Now adding 24 at the fourth position
11
12
13
24
14
Length of the linked list: 5
Deleting 24 from the LL
11
12
13
14
PS C:\Users\OS\Desktop\6th Semester\CSE2003 Data Structures and Algorithms\Code\LAB3>
```

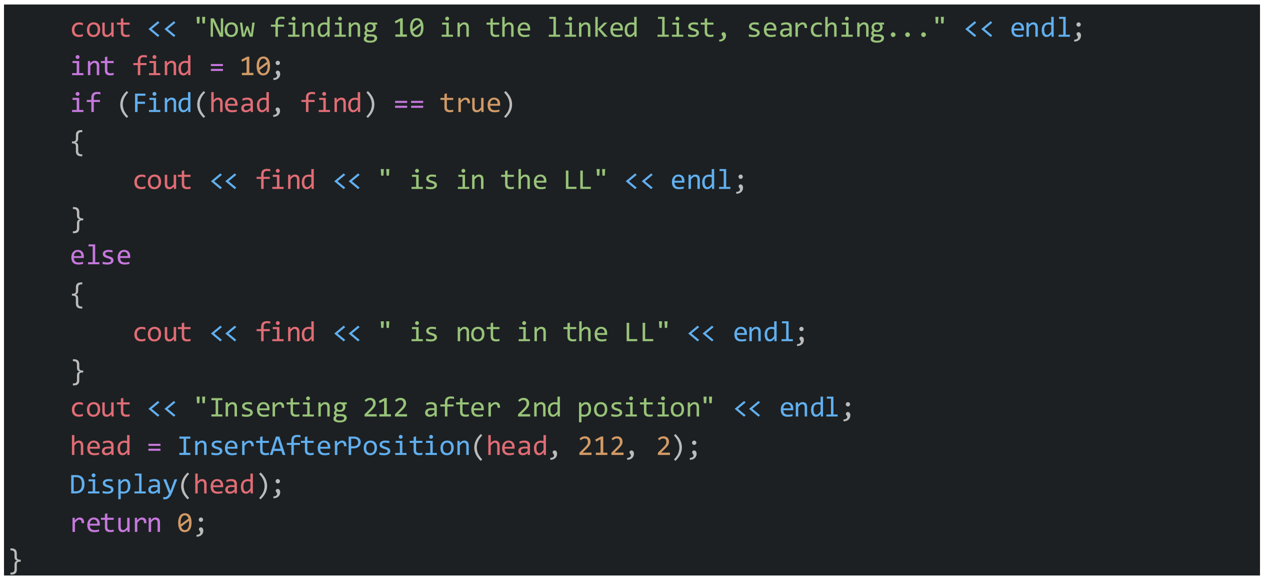
Task 2: Implement singly circular linked list and perform create, insert, display, count, and delete operations.

Code:

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

struct Node
{
    int data;
    Node *next;
};
void Display(struct Node *head)
{
    if (head == NULL)
    {
        cout << "Circular linked list is empty!" << endl;
        return;
    }
    struct Node *initial = head;
    do
    {
        cout << head->data << endl;
        head = head->next;
    } while (head != initial);
}
int GetLength(struct Node *head)
{
    int length = 0;
    if (head == NULL)
    {
        return length;
    }
    else if (head != NULL && head->next == NULL)
        return 1;
    else
    {
        struct Node *initial = head;
        head = head->next;
        length = 1;
        while (head != initial)
        {
            length++;
            head = head->next;
        }
        return length;
    }
}
struct Node *Append(struct Node *head, int data) //Will add an element just
before the head (and just after the element that points to the head)
{
    struct Node *temp = new Node;
    temp->data = data;
    if (GetLength(head) == 0)
    {
        head = temp;
        head->next = head;
    }
    else
    {
        struct Node *initial = head;
        while (head->next != initial)
        {
            head = head->next;
        }
        temp->next = initial;
        head->next = temp;
        head = initial;
    }
    return head;
}
struct Node *Front(struct Node *head, int data)
{
    struct Node *temp = new Node;
    temp->data = data;
    if (GetLength(head) == 0)
    {
        head = temp;
        head->next = head;
    }
    else
    {
        struct Node *initial = head;
        while (head->next != initial)
        {
            head = head->next;
        }
        temp->next = initial;
        head->next = temp;
        head = temp;
    }
    return head;
}
struct Node *Delete(struct Node *head, int data)
{
    struct Node *last = head;
    struct Node *initial = head;
    if (head == NULL)
    {
        cout << "LL is empty!" << endl;
        return head;
    }
    if (head->data == data)
    {
        while (last->next != head)
        {
            last = last->next;
        }
        last->next = head->next;
        head = NULL;
        head = last->next;
        return head;
    }
    while (last->next != head && last->next->data != data)
    {
        last = last->next;
    }
    if (last->next->data == data)
    {
        struct Node *temp = last->next;
        last->next = temp->next;
        while (last != initial)
            last = last->next;
        return last;
    }

    return head;
}
bool Find(struct Node *head, int data)
{
    struct Node *initial = head;
    while (head->next != initial)
    {
```

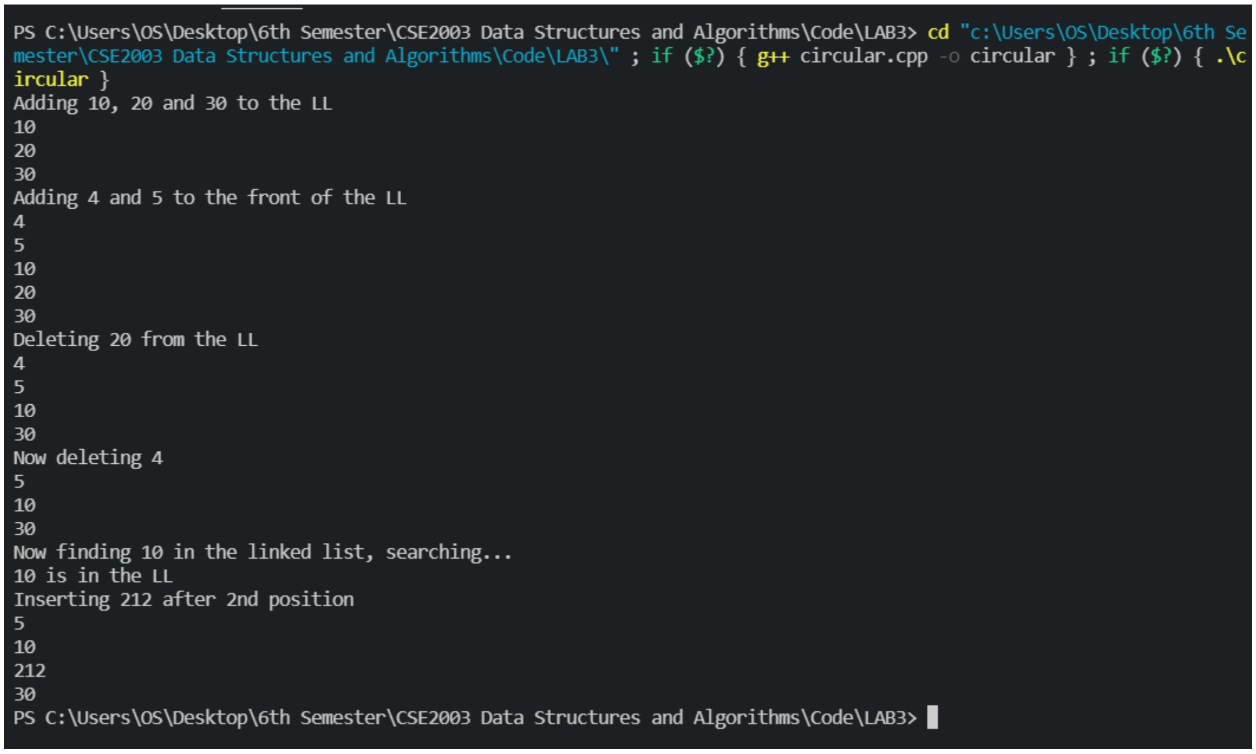


```
        if (head->data == data)
        {
            return true;
        }
        head = head->next;
    }
    return false;
}
struct Node *InsertAfterPosition(struct Node *head, int data, int pos)
{
    struct Node *initial = head;
    int i = 1;
    while (i != pos)
    {
        head = head->next;
        i+=1;
    }
    struct Node *temp = new Node;
    temp->data = data;
    temp->next = head->next;
    head->next = temp;
    head = initial;
    return head;

}
int main()
{

    struct Node *head = new Node;
    head = NULL;
    cout << "Adding 10, 20 and 30 to the LL" << endl;
    head = Append(head, 10);
    head = Append(head, 20);
    head = Append(head, 30);
    Display(head);
    cout << "Adding 4 and 5 to the front of the LL" << endl;
    head = Front(head, 5);
    head = Front(head, 4);
    Display(head);
    cout << "Deleting 20 from the LL" << endl;
    head = Delete(head, 20);
    Display(head);
    cout << "Now deleting 4" << endl;
    head = Delete(head, 4);
    Display(head);
```



```cpp
    cout << "Now finding 10 in the linked list, searching..." << endl;
    int find = 10;
    if (Find(head, find) == true)
    {
        cout << find << " is in the LL" << endl;
    }
    else
    {
        cout << find << " is not in the LL" << endl;
    }
    cout << "Inserting 212 after 2nd position" << endl;
    head = InsertAfterPosition(head, 212, 2);
    Display(head);
    return 0;
}
```

Output:



```
PS C:\Users\OS\Desktop\6th Semester\CSE2003 Data Structures and Algorithms\Code\LAB3> cd "c:\Users\OS\Desktop\6th Se
mester\CSE2003 Data Structures and Algorithms\Code\LAB3\" ; if ($?) { g++ circular.cpp -o circular } ; if ($?) { .\c
ircular }
Adding 10, 20 and 30 to the LL
10
20
30
Adding 4 and 5 to the front of the LL
4
5
10
20
30
Deleting 20 from the LL
4
5
10
30
Now deleting 4
5
10
30
Now finding 10 in the linked list, searching...
10 is in the LL
Inserting 212 after 2nd position
5
10
212
30
PS C:\Users\OS\Desktop\6th Semester\CSE2003 Data Structures and Algorithms\Code\LAB3> 
```

Conclusion

Thus, we have successfully implemented singly-linear and singly-circular linked lists and perform create, insert, search, count and delete operations of the same. Hence, the experiment is complete.

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