Bahria University, Islamabad

Department of Software Engineering

Data Structures & Algorithms Lab

(Spring-2024)

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Comments:

Signature

Code:

All the code files are uploaded on GitHub: https://github.com/CharlieFour/DSA_Lab

You can check out the code on GitHub in Lab_05 folder.

Class file (used in both tasks):

Both tasks are solved in the same way, so I just create only one exe.

List.h

```
typedef struct Node* Nodeptr;

struct Node{
    int data;
    Nodeptr next;
};

class LinkedList{
    private:
        Nodeptr head;
    public:
        int length;
        LinkedList();
        void traverse();
        Nodeptr find(int);
        void iAS(int x);
        int dAS();
        void iAE(int x);
        int dAE();
        int iAM(int x, int index);
        int dAM(int index);
        void saveList();
        void loadList();
};
```

List.cpp

```cpp
#include "list.h"
#include <iostream>
#include <fstream>

LinkedList::LinkedList(){
    head = nullptr;
    length = 0;

}

void LinkedList::iAS(int x){
    Nodeptr p = new Node;
    p->data = x;
    p->next = head;
    head = p;

    length++;
}

int LinkedList::dAS(){
    if(head == nullptr){
        return -1;
    }
    if(head->next == nullptr){
        int x = head->data;
        head = nullptr;
        return x;
    }
    Nodeptr p = head->next;
    int x = head->data;
    delete head;
    head = p;

    length--;

    return x;
}

void LinkedList::traverse(){
    for(Nodeptr p = head; p != nullptr; p = p->next){
        std::clog << p->data << std::endl;
    }
}
```

```
Nodeptr LinkedList::find(int x){
    for(Nodeptr p = head; p != nullptr; p = p->next){
        if(p->data == x){
            return p;
        }
    }
    return nullptr;
}

void LinkedList::iAE(int x){
    if(head == nullptr){
        iAS(x);
    }
    Nodeptr p = head;
    while(p->next != nullptr){
        p = p->next;
    }
    Nodeptr q = new Node;
    q->data = x;
    q->next = nullptr;
    p->next = q;

    length++;
}

int LinkedList::dAE(){
    if(head == nullptr){
        return -1;
    }
    if(length == 1){
        return dAS();
    }
    Nodeptr p = head;
    Nodeptr q = nullptr;
    while(p->next != nullptr){
        if(p->next->next == nullptr){
            q = p;
        }
        p = p->next;
    }
    int x = p->data;
    delete p;
    q->next = nullptr;

    length--;

    return x;
}
```

```cpp
int LinkedList::iAM(int x, int index){
    Nodeptr p = head;
    int i = 0;
    Nodeptr q = nullptr;
    while(p->next != nullptr){
        if(i == index){
            q = p;
            break;
        }
        i++;
        p = p->next;
    }

    if(q == nullptr){
        return -1;
    }
    Nodeptr r = new Node;
    r->data = x;
    r->next = q->next;
    q->next = r;

    length++;
    return 0;
}

int LinkedList::dAM(int index){
    Nodeptr p = head;
    int i = 0;
    Nodeptr q = nullptr;
    while(p->next != nullptr){
        if(i == index - 1){
            q = p;
        }
        if(i == index){
            break;
        }
        i++;
        p = p->next;
    }

    if(q == nullptr){
        return -1;
    }
    int x = p->data;
    q->next = p->next;
    delete p;

    length--;

    return x;
}
```

```cpp
void LinkedList::saveList()
{
    std::ofstream file("data/list.txt");
    for(Nodeptr p = head; p != nullptr; p = p->next)
    {
        file << p->data << std::endl;
    }
    file.close();
}

void LinkedList::loadList()
{
    std::ifstream file("data/list.txt");
    if(file.is_open())
    {
        int x;
        while(file >> x)
        {
            iAE(x);
        }
        file.close();
    }
    else
    {
        std::cerr << "File not found" << std::endl;
        system("pause");
    }
}
```

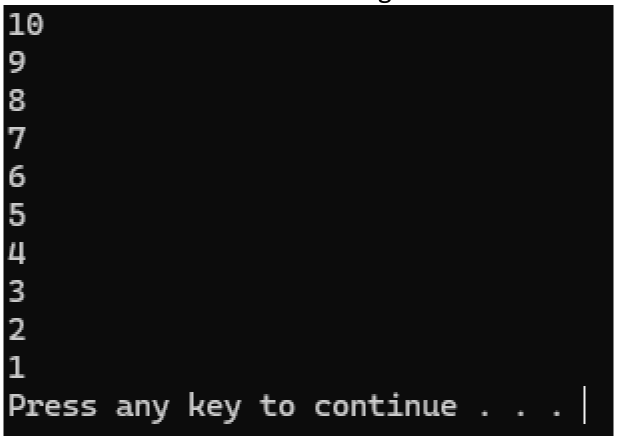
Main.cpp

```cpp
#include <iostream>
#include <limits>
#include "../libraries/list.h"

using namespace std;

void takeInput(int &input);
void printMenu();
void useList(LinkedList &list);

main()
{
    LinkedList list;
    list.loadList();
    useList(list);
    list.saveList();
    system("pause");
    return 0;
}
```

```
void printMenu()
{
    cout << "1. Insertion at the start" << endl;
    cout << "2. Insertion at the end" << endl;
    cout << "3. Insertion at the middle" << endl;
    cout << "4. Deletion from the start" << endl;
    cout << "5. Deletion from the end" << endl;
    cout << "6. Deletion from the middle" << endl;
    cout << "7. Search for an element" << endl;
    cout << "8. Display the list" << endl;
    cout << "9. Exit" << endl;
}

void takeInput(int &input)
{
    bool check = false;
    do
    {
        system("cls");
        printMenu();
        cout << "Enter the input: ";
        if(cin >> input)
        {
            check = false;
        }
        else
        {
            cin.clear();
            cin.ignore(numeric_limits<streamsize>::max(), '\n');
            cerr << "Invalid input. Please enter a valid
integer." << endl;
            check = true;
            system("pause");
        }
    }
    while(check);
}
void useList(LinkedList &list)
{
    int choice, input, index; // inputList used to input in list
    do
    {
        takeInput(choice);
        if (choice == 1)
        {
            cout << "Enter the element to be inserted: ";
            cin >> input;
            list.iAS(input);
        }
        else if (choice == 2)
        {
            cout << "Enter the element to be inserted: ";
            cin >> input;
            list.iAE(input);
        }
        else if (choice == 3)
        {
            cout << "Enter the element to be inserted: ";
            cin >> input;
            cout << "Enter the index of the element: ";
            cin >> index;
            list.iAM(input,index);
        }
        else if (choice == 4)
        {
            list.dAS();
        }
        else if (choice == 5)
        {
            list.dAE();
        }
        else if (choice == 6)
        {
            cout << "Enter the index of the element: ";
            cin >> index;
            list.dAM(index);
        }
        else if (choice == 7)
        {
            cout << "Enter the element to search for: ";
            cin >> input;
            Nodeptr node = list.find(input);
            cout << ((node == nullptr) ? "Element not found" :
"Element found") << endl;
            system("pause");
        }
        else if (choice == 8)
        {
            list.traverse();
            system("pause");
        }
    }
    while(choice != 9);
}
```

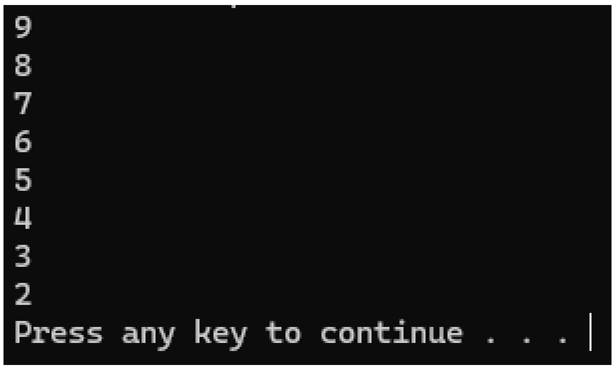
Screen Shots:

Numbers inserted using insertion function.



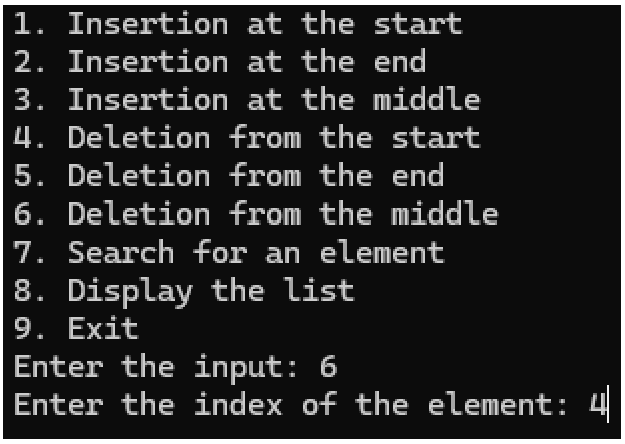
```
10
9
8
7
6
5
4
3
2
1
Press any key to continue . . .
```

After deleting from start and end.

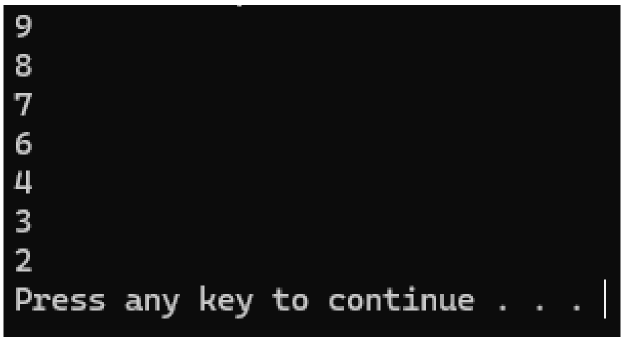


```
9
8
7
6
5
4
3
2
Press any key to continue . . .
```

After deleting from middle.



```
1. Insertion at the start
2. Insertion at the end
3. Insertion at the middle
4. Deletion from the start
5. Deletion from the end
6. Deletion from the middle
7. Search for an element
8. Display the list
9. Exit
Enter the input: 6
Enter the index of the element: 4
```



```
9
8
7
6
4
3
2
Press any key to continue . . .
```