DATA STRUCTURE AND ALOGRITHUM

Lab Report

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Experiment # 1
DOUBLE LINK LIST

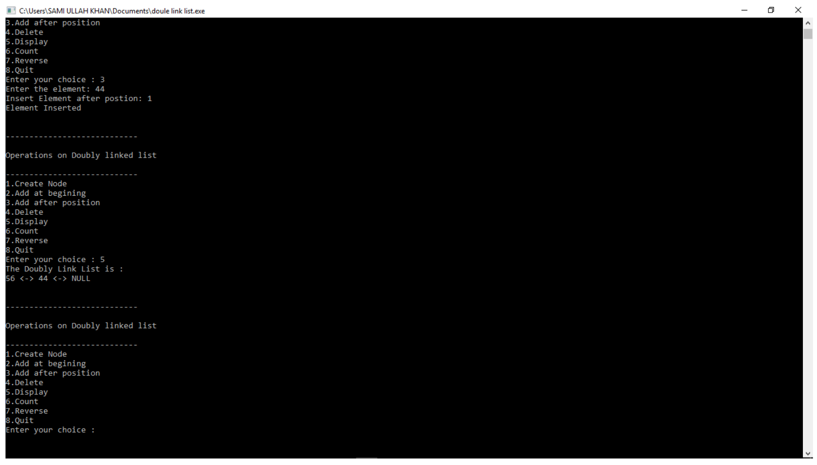
Objective
To understand the meaninig and implementation of double link list.

Software Tool
1.
DEV C++

1 Theory

Doubly Linked List is a variation of Linked list in which navigation is possible in both ways, either forward and backward easily as compared to Single Linked List. Following are the important terms to understand the concept of doubly linked list. Link Each link of a linked list can store a data called an element. Next Each link of a linked list contains a link to the next link called Next. Prev Each link of a linked list contains a link to the previous link called Prev. LinkedList A Linked List contains the connection link to the first link called First and to the last link called Last. Doubly Linked List Representation

As per the above illustration, following are the important points to be considered. Doubly Linked List contains a link element called first and last. Each link carries a data field(s) and two link fields called next and prev. Each link is linked with its next link using its next link. Each link is linked with its previous link using its previous link. The last link carries a link as null to mark the end of the list. Basic Operations Following are the basic operations supported by a list. 1. CREATE NEW NODE 2. ADD AT BEGINNING 3. ADD AFTER POSITIO 4. DELETE 5. DISPLAY 6. COUNT 7. REVERSE 8. QUIT



C:\Users\SAMI ULLAH KHAN\Documents\doule link list.exe

```
3.Add after position
4.Delete
5.Display
6.Count
7.Reverse
8.Quit
Enter your choice : 3
Enter the element: 44
Insert Element after postion: 1
Element Inserted


----------------------------

Operations on Doubly linked list

----------------------------
1.Create Node
2.Add at begining
3.Add after position
4.Delete
5.Display
6.Count
7.Reverse
8.Quit
Enter your choice : 5
The Doubly Link List is :
56 <-> 44 <-> NULL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Operations on Doubly linked list

----------------------------
1.Create Node
2.Add at begining
3.Add after position
4.Delete
5.Display
6.Count
7.Reverse
8.Quit
Enter your choice :
```

Figure 1: Time Independent Feature Set

2 Task

2.1 Procedure: Task 1

The minimum number of moves required to solve a Tower of Hanoi puzzle is 2n - 1, where n is the number of disks.

```
#include<iostream>
#include<cstdio>
#include<cstdlib>
/*
 * Node Declaration
 */
using namespace std;
struct node
{
    int info;
    struct node *next;
    struct node *prev;
}*start;

/*
 Class Declaration
 */
class double_llist
{
    public:
        void create_list(int value);
        void add_begin(int value);
        void add_after(int value, int position);
        void delete_element(int value);
        void search_element(int value);
        void display_dlist();
        void count();
        void reverse();
        double_llist()
        {
            start = NULL;
        }
};

/*
 * Main: Conatins Menu
 */
int main()
{
    int choice, element, position;
    double_llist dl;
    while (1)
    {
        cout<<endl<<"----------------------------"<<endl;
        cout<<endl<<"Operations on Doubly linked list"<<endl;
        cout<<endl<<"----------------------------"<<endl;
        cout<<"1.Create Node"<<endl;
        cout<<"2.Add at begining"<<endl;
        cout<<"3.Add after position"<<endl;
        cout<<"4.Delete"<<endl;
        cout<<"5.Display"<<endl;
        cout<<"6.Count"<<endl;
        cout<<"7.Reverse"<<endl;
        cout<<"8.Quit"<<endl;
        cout<<"Enter your choice : ";
        cin>>choice;
```

```
switch ( choice )
{
case 1:
    cout<<"Enter␣the␣element:␣";
    cin>>element;
    dl.create_list(element);
    cout<<endl;
    break;
case 2:
    cout<<"Enter␣the␣element:␣";
    cin>>element;
    dl.add_begin(element);
    cout<<endl;
    break;
case 3:
    cout<<"Enter␣the␣element:␣";
    cin>>element;
    cout<<"Insert␣Element␣after␣postion:␣";
    cin>>position;
    dl.add_after(element, position);
    cout<<endl;
    break;
case 4:
    if (start == NULL)
    {
        cout<<"List␣empty,nothing␣to␣delete"<<endl;
        break;
    }
    cout<<"Enter␣the␣element␣for␣deletion:␣";
    cin>>element;
    dl.delete_element(element);
    cout<<endl;
    break;
case 5:
    dl.display_dlist();
    cout<<endl;
    break;
case 6:
    dl.count();
    break;
```

```
        case 7:
            if (start == NULL)
            {
                cout<<"List empty, nothing to reverse"<<endl;
                break;
            }
            dl.reverse();
            cout<<endl;
            break;
        case 8:
            exit(1);
        default:
            cout<<"Wrong choice"<<endl;
        }
    }
    return 0;
}

/*
 * Create Double Link List
 */
void double_llist::create_list(int value)
{
    struct node *s, *temp;
    temp = new(struct node);
    temp->info = value;
    temp->next = NULL;
    if (start == NULL)
    {
        temp->prev = NULL;
        start = temp;
    }
    else
    {
        s = start;
        while (s->next != NULL)
            s = s->next;
        s->next = temp;
        temp->prev = s;
    }
```

```
}

/*
 * Insertion at the beginning
 */
void double_llist::add_begin(int value)
{
    if (start == NULL)
    {
        cout<<"First␣Create␣the␣list."<<endl;
        return;
    }
    struct node *temp;
    temp = new(struct node);
    temp->prev = NULL;
    temp->info = value;
    temp->next = start;
    start->prev = temp;
    start = temp;
    cout<<"Element␣Inserted"<<endl;
}

/*
 * Insertion of element at a particular position
 */
void double_llist::add_after(int value, int pos)
{
    if (start == NULL)
    {
        cout<<"First␣Create␣the␣list."<<endl;
        return;
    }
    struct node *tmp, *q;
    int i;
    q = start;
    for (i = 0;i < pos - 1;i++)
    {
        q = q->next;
        if (q == NULL)
        {
            cout<<"There␣are␣less␣than␣";
            cout<<pos<<"␣elements."<<endl;
            return;
        }
    }
    tmp = new(struct node);
    tmp->info = value;
    if (q->next == NULL)
    {
        q->next = tmp;
        tmp->next = NULL;
        tmp->prev = q;
    }
    else
    {
        tmp->next = q->next;
        tmp->next->prev = tmp;
        q->next = tmp;
        tmp->prev = q;
    }
    cout<<"Element␣Inserted"<<endl;
}

/*
 * Deletion of element from the list
 */
void double_llist::delete_element(int value)
{
    struct node *tmp, *q;
     /*first element deletion*/
    if (start->info == value)
    {
        tmp = start;
        start = start->next;
        start->prev = NULL;
        cout<<"Element␣Deleted"<<endl;
        free(tmp);
        return;
    }
    q = start;
    while (q->next->next != NULL)
    {
        /*Element deleted in between*/
        if (q->next->info == value)
        {
            tmp = q->next;
            q->next = tmp->next;
            tmp->next->prev = q;
            cout<<"Element Deleted"<<endl;
            free(tmp);
            return;
        }
        q = q->next;
    }
     /*last element deleted*/
    if (q->next->info == value)
    {
        tmp = q->next;
        free(tmp);
        q->next = NULL;
        cout<<"Element Deleted"<<endl;
        return;
    }
    cout<<"Element "<<value<<" not found"<<endl;
}

/*
 * Display elements of Doubly Link List
 */
void double_llist::display_dlist()
{
    struct node *q;
    if (start == NULL)
    {
        cout<<"List empty, nothing to display"<<endl;
        return;
    }
    q = start;
    cout<<"The Doubly Link List is :"<<endl;
    while (q != NULL)
    {
        cout<<q->info<<" <-> ";
        q = q->next;
    }
    cout<<"NULL"<<endl;
}

/*
 * Number of elements in Doubly Link List
 */
void double_llist::count()
{
    struct node *q = start;
    int cnt = 0;
    while (q != NULL)
    {
        q = q->next;
        cnt++;
    }
    cout<<"Number of elements are: "<<cnt<<endl;
}

/*
 * Reverse Doubly Link List
 */
void double_llist::reverse()
{
    struct node *p1, *p2;
    p1 = start;
    p2 = p1->next;
    p1->next = NULL;
    p1->prev = p2;
    while (p2 != NULL)
    {
        p2->prev = p2->next;
        p2->next = p1;
        p1 = p2;
        p2 = p2->prev;
    }
    start = p1;
    cout<<"List␣Reversed"<<endl;
}
```

3 Conclusion

in this lab we perform the basics function of double link list insertion deletion insertion at any n postion display reverse etc