

## 2. Implementation of Doubly Linked List

Program :

```
#include <stdio.h>

#include <stdlib.h>

struct node {
    struct node * Prev;
    int Element;
    struct node * Next;
};

typedef struct node Node;
int IsEmpty(Node * List);
int IsLast(Node * Position);
Node * Find(Node * List, int x);
void InsertBeg(Node * List, int e);
void InsertLast(Node * List, int e);
void InsertMid(Node * List, int p, int e);
void DeleteBeg(Node * List);
void DeleteEnd(Node * List);
void DeleteMid(Node * List, int e);
void Traverse(Node * List);
int main() {
    Node * List = malloc(sizeof(Node));
    List -> Prev = NULL;
    List -> Next = NULL;
    Node * Position;
    int ch, e, p;
    printf("1.Insert Beg \n2.Insert Middle \n3.Insert End");
    printf("\n4.Delete Beg \n5.Delete Middle \n6.Delete End");
    printf("\n7.Find \n8.Traverse \n9.Exit\n");
    do {
        printf("Enter your choice : ");
        scanf("%d", & ch);
        switch (ch) {
            case 1:
                printf("Enter the element : ");
                scanf("%d", & e);
                InsertBeg(List, e);
                break;
            case 2:
                printf("Enter the position element : ");
                scanf("%d", & p);
                printf("Enter the element : ");
                scanf("%d", & e);
                InsertMid(List, p, e);
                break;
            case 3:
                printf("Enter the element : ");
                scanf("%d", & e);
                InsertLast(List, e);
                break;
            case 4:
                DeleteBeg(List);
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        break;
    case 5:
        printf("Enter the element : ");
        scanf("%d", & e);
        DeleteMid(List, e);
        break;
    case 6:
        DeleteEnd(List);
        break;
    case 7:
        printf("Enter the element : ");
        scanf("%d", & e);
        Position = Find(List, e);
        if (Position != NULL)
            printf("Element found...!\n");
        else
            printf("Element not found...!\n");
        break;
    case 8:
        Traverse(List);
        break;
    }
} while (ch <= 8);
return 0;
}

int IsEmpty(Node * List) {
    if (List -> Next == NULL)
        return 1;
    else
        return 0;
}

int IsLast(Node * Position) {
    if (Position -> Next == NULL)
        return 1;
    else
        return 0;
}

Node * Find(Node * List, int x) {
    Node * Position;
    Position = List -> Next;
    while (Position != NULL && Position -> Element != x)
        Position = Position -> Next;
    return Position;
}

void InsertBeg(Node * List, int e) {
    Node * NewNode = malloc(sizeof(Node));
    NewNode -> Element = e;
    if (IsEmpty(List))
        NewNode -> Next = NULL;
    else {
        NewNode -> Next = List -> Next;
        NewNode -> Next -> Prev = NewNode;
    }
    NewNode -> Prev = List;
    List -> Next = NewNode;
}

void InsertLast(Node * List, int e) {

```

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Node * NewNode = malloc(sizeof(Node));
Node * Position;
NewNode -> Element = e;
NewNode -> Next = NULL;
if (IsEmpty(List)) {
    NewNode -> Prev = List;
    List -> Next = NewNode;
} else {
    Position = List;
    while (Position -> Next != NULL)
        Position = Position -> Next;
    Position -> Next = NewNode;
    NewNode -> Prev = Position;
}
}

void InsertMid(Node * List, int p, int e) {
    Node * NewNode = malloc(sizeof(Node));
    Node * Position;
    Position = Find(List, p);
    NewNode -> Element = e;
    NewNode -> Next = Position -> Next;
    Position -> Next -> Prev = NewNode;
    Position -> Next = NewNode;
    NewNode -> Prev = Position;
}

void DeleteBeg(Node * List) {
    if (!IsEmpty(List)) {
        Node * TempNode;
        TempNode = List -> Next;
        List -> Next = TempNode -> Next;
        if (List -> Next != NULL)
            TempNode -> Next -> Prev = List;
        printf("The deleted item is %d\n", TempNode -> Element);
        free(TempNode);
    } else
        printf("List is empty...\n");
}

void DeleteEnd(Node * List) {
    if (!IsEmpty(List)) {
        Node * Position;
        Node * TempNode;
        Position = List;
        while (Position -> Next != NULL)
            Position = Position -> Next;
        TempNode = Position;
        Position -> Prev -> Next = NULL;
        printf("The deleted item is %d\n", TempNode -> Element);
        free(TempNode);
    } else
        printf("List is empty...\n");
}

void DeleteMid(Node * List, int e) {
    if (!IsEmpty(List)) {
        Node * Position;
        Node * TempNode;
        Position = Find(List, e);
        if (!IsLast(Position)) {

```

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        TempNode = Position;
        Position -> Prev -> Next = Position -> Next;
        Position -> Next -> Prev = Position -> Prev;
        printf("The deleted item is %d\n", TempNode -> Element);
        free(TempNode);
    }
} else
    printf("List is empty...!\n");
}

void Traverse(Node * List) {
    if (!IsEmpty(List)) {
        Node * Position;
        Position = List;
        while (Position -> Next != NULL) {
            Position = Position -> Next;
            printf("%d\t", Position -> Element);
        }
        printf("\n");
    } else
        printf("List is empty...!\n");
}

```

#### Output :

```

1.Insert Beg
2.Insert Middle
3.Insert End
4.Delete Beg
5.Delete Middle
6.Delete End
7.Find
8.Traverse
9.Exit
Enter your choice : 1
Enter the element : 40
Enter your choice : 1
Enter the element : 30
Enter your choice : 1
Enter the element : 20
Enter your choice : 1
Enter the element : 10
Enter your choice : 8
10 20 30 40
Enter your choice : 7
Enter the element : 30
Element found...!
Enter your choice : 1
Enter the element : 5
Enter your choice : 8
5 10 20 30 40
Enter your choice : 3
Enter the element : 45
Enter your choice : 8
5 10 20 30 40 45

```

```
Enter your choice : 2
Enter the position element : 20
Enter the element : 25
Enter your choice : 8
5 10 20 25 30 40 45
Enter your choice : 4
The deleted item is 5
Enter your choice : 8
10 20 25 30 40 45
Enter your choice : 6
The deleted item is 45
Enter your choice : 8
10 20 25 30 40
Enter your choice : 5
Enter the element : 30
The deleted item is 30
Enter your choice : 8
10 20 25 40
Enter your choice : 9
```