



Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA : 3.18)



Department of Information Technology

COURSE CODE: DJS22ITL302

DATE: 25-10-23

COURSE NAME: Data Structure Laboratory

CLASS: II-Batch1

NAME: Ayush Vinod Upadhyay

SAP ID: 60003220131

ROLL NO.: I025

Experiment No. 5

CO/LO: CO1

Aim: Implementation of Doubly Linked List

Theory: A Doubly Linked List (DLL) is a type of linked list in which each node contains a pointer to the previous node as well as the next node of the linked list.

Properties:-

- Each node contains three parts : data, a pointer to the next node and a pointer to the previous node.
- It can be traversed in both forward and backward direction.
- The first node's previous pointer points to null and last node's next pointer points to null.

Operations:-

- **Insertion:-** This can be done at the beginning, end or any position.
- **Deletion:-** This can be done at the beginning, at the end or specific position.
- **Traversal:-** It allows backward traversal if required.



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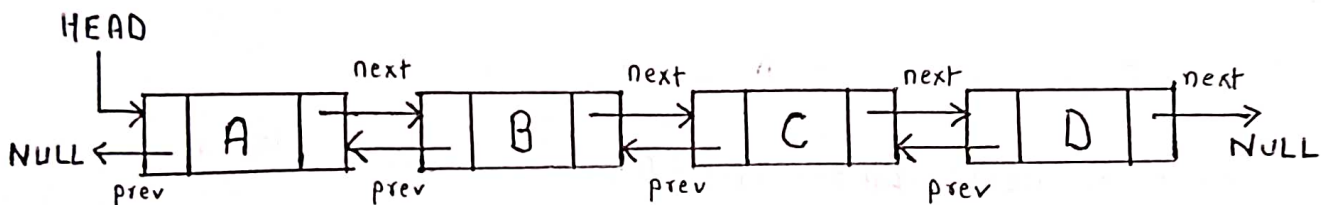


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Applications:

- Doubly linked list are used in web page navigation in both forward and backward direction.
- They are used to implement different tree data structures.

Output :



Doubly Linked List.

Conclusion : I learnt the implementation of doubly linked list and performed various operations on it.

References : Greeks for Greeks , W3School for theory
Self implemented the code.



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Program:

```
#include<stdio.h>
#include<stdlib.h>

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

void display(struct Node * head){
    struct Node * p = head;
    while (p != NULL) {
        printf("%d ", p->data);
        p=p->next;
    }
    printf("\n \n");
}

struct Node * insertAtStart(struct Node * head){
    int data;
    printf("Enter data to be inserted at Start ");
    scanf("%d", &data);
    struct Node * newnode = malloc(sizeof(struct Node));
    newnode->data=data;
    newnode->prev=NULL;
    newnode->next=head;
    if(head != NULL) {
        head->prev=newnode;
    }
    head=newnode;
    printf("%d is inserted at Start\n \n",data);
    return head;
}

struct Node * insertAtEnd(struct Node * head){
    int data;
    printf("Enter data to be inserted at End ");
    scanf("%d", &data);
    struct Node * newnode = malloc(sizeof(struct Node));
    newnode->data=data;
    newnode->next=NULL;
```



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```
    if (head==NULL)
    {
        newnode->prev=NULL;
        head=newnode;
    }
    else{
        struct Node * p = head;
        while(p->next !=NULL){
            p=p->next;
        }
        newnode->prev=p;
        p->next=newnode;
    }
    printf("%d is inserted at End\n \n",data);
    return head;
}

struct Node * insertAtPosition(struct Node * head){
    int data, position;
    printf("Enter data to be inserted ");
    scanf("%d", &data);
    printf("Enter the position you want to insert data ");
    scanf("%d",&position);
    struct Node * newnode = malloc(sizeof(struct Node));
    newnode->data=data;
    struct Node * p = head;
    int i;
    for ( i = 1; i < position; i++)
    {
        p=p->next;
    }
    newnode->prev=p;
    newnode->next=p->next;
    (p->next)->prev=newnode;
    p->next=newnode;
    printf("%d is inserted at %d \n \n",data, position);
    return head;
}

struct Node * deleteAtStart(struct Node * head){
    if (head==NULL)
    {
```




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```
        printf("No elements present to delete\n \n");
    }
    else{
        printf("%d is deleted from Start \n \n", head->data);
        head=head->next;
    }
    return head;
}

struct Node * deleteAtEnd(struct Node * head){
    if (head==NULL)
    {
        printf("No elements present to delete\n \n");
    }
    else{
        struct Node * p = head;
        while ((p->next)->next != NULL){
            p=p->next;
        }
        printf("%d is deleted from End \n \n", (p->next)->data);
        p->next=NULL;
    }
    return head;
}

struct Node * deleteAtPosition(struct Node * head){
    if (head==NULL)
    {
        printf("No elements present to delete\n \n");
    }
    else{
        int position;
        printf("Enter the position you want to delete data ");
        scanf("%d",&position);
        struct Node * p = head;
        int i;
        for ( i = 1; i < position && p != NULL; i++)
        {
            p=p->next;
        }
        if (p == NULL) {
            printf("Position exceeds length of linked list\n \n");
        }
    }
}
```



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```
        return head;
    }
    printf("%d is deleted at %d \n \n", (p->next)->data, position);
    ((p->next)->next)->prev=p;
    p->next=(p->next)->next;
}
return head;
}

int main()
{
    struct Node * head = NULL;
    int choice=-1;
    while (choice != 10)
    {
        printf("Enter 0 to display \nEnter 1 to insert at start \nEnter 2 to
insert at End \nEnter 3 to insert at any position \nEnter 4 to delete at Start
\nEnter 5 to delete at End \nEnter 6 to delete any position \nEnter 10 to exit
\n");
        scanf("%d", &choice);
        if (choice==0){
            display(head);
        }
        else if (choice==1)
        {
            head=insertAtStart(head);
        }else if (choice==2)
        {
            head=insertAtEnd(head);
        }
        else if (choice==3)
        {
            head=insertAtPosition(head);
        }
        else if (choice==4)
        {
            head=deleteAtStart(head);
        }
        else if (choice ==5)
        {
            head=deleteAtEnd(head);
        }
    }
}
```



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```
        else if (choice==6)
        {
            head=deleteAtPosition(head);
        }
        else if(choice==10){
            break;
        }
    }
    return 0;
}
```

Output screenshots:

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 30
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
2
Enter data to be inserted at End 40
40 is inserted at End
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 30 40
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 30 40
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
1
Enter data to be inserted at Start 100
100 is inserted at Start
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
100 10 20 30 40
```



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```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 30 40

Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
3
Enter data to be inserted 100
Enter the position you want to insert data 2
100 is inserted at 2

Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 100 30 40
```




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```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
100 10 20 30 40
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
4
100 is deleted from Start
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 30 40
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 30 40
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
5
40 is deleted from End
```

```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 30
```



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```
Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 30 40 50

Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
6
Enter the position you want to delete data 2
30 is deleted at 2

Enter 0 to display
Enter 1 to insert at start
Enter 2 to insert at End
Enter 3 to insert at any position
Enter 4 to delete at Start
Enter 5 to delete at End
Enter 6 to delete any position
Enter 10 to exit
0
10 20 40 50
```