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Doubly-Linked List

A doubly linked list is a linked list in which each node has three fields namely Data, Next, Prev.

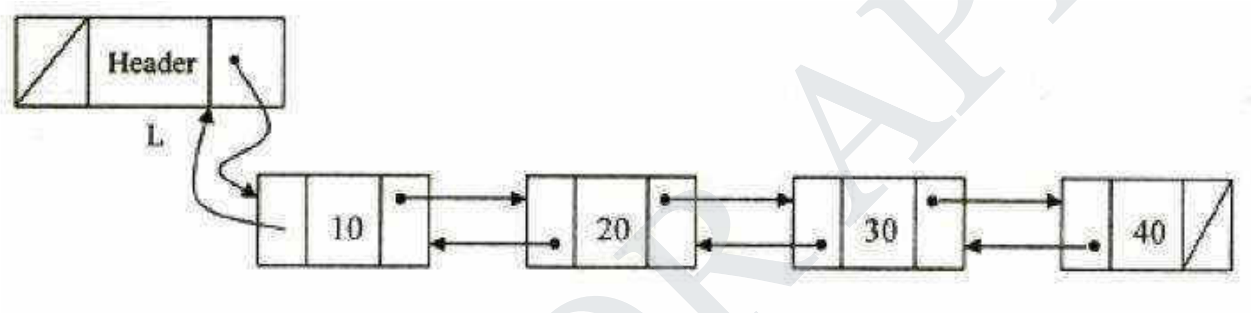
Data-This field stores the value of the element

Next-This field points to the successor node in the list

Prev-This field points to the predecessor node in the list

PREV	DATA	NEXT

DLL NODE



DOUBLY LINKED LIST

Basic operations of a doubly -linked list are:

1. Insert – Inserts a new element at the end of the list.
2. Delete – Deletes any node from the list.
3. Find – Finds any node in the list.
4. Print – Prints the list

Declaration of DLL Node

```
typedef struct node *position ;
struct node
{
int data;
      position prev;
      position next;
};
```

PREV	DATA	NEXT

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Creation of list in DLL

Initially the list is empty. Then assign the first node as head.

```
newnode->data=X;

newnode->next=NULL;

newnode->prev=NULL;

L=newnode;
```

If we add one more node in the list,then create a newnode and attach that node to the end of the list.

```
L->next=newnode;

newnode->prev=L;
```

Routine to insert an element in a DLL at the beginning

```
void Insert (int x, list L, position P){

struct node  *Newnode;

if(pos==1)

P=L;

Newnode = (struc node*)malloc (sizeof(struct  node));

if (Newnode! = NULL)

Newnode->data= X;

Newnode ->next= L ->next;

L->next ->prev=Newnode

L->next = Newnode;

Newnode ->prev = L;

}
```

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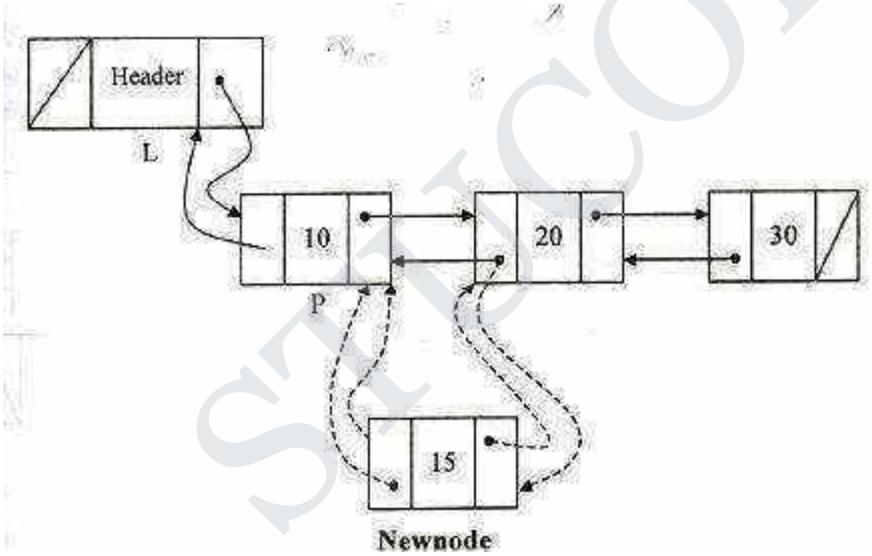
Routine to insert an element in a DLL any position :

```
void Insert (int x, list L, position P)

{

struct node  *Newnode;

Newnode = (struc node*)malloc (sizeof(struct  node));

if (Newnode! = NULL)

Newnode->data= X;

Newnode ->next= P ->next;

P->next ->prev=Newnode

P ->next = Newnode;

Newnode ->prev = P:

}
```



Routine to insert an element in a DLL at the end:

```
void insert(int X, List L, position p)
{
          p=L;
          newnode=(struct node*)malloc(sizeof(struct node));
```

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```
            printf("\nEnter the data to be inserted\n");
            scanf("%d",&newnode->data);
            while(p->next!=NULL)
            p=p->next;
            newnode->next=NULL;
            p->next=newnode;
            newnode->prev=p;
    }
```

Routine for deleting an element:

```
     void Delete (int x ,List L)
     {
      Position p , temp;
     P = Find( x, L );
     if(P==L->next)
     temp=L;
     L->next=temp->next;
     temp->next->prev=L;
     free(temp);
     elseif( IsLast( p, L ) )
       {
         temp = p;
          p -> prev -> next = NULL;
          free(temp);
       }
      else
      {
       temp = p;
       p -> prev -> next = p -> next;
      p -> next -> prev = p -> prev;
      free(temp);
    }
```

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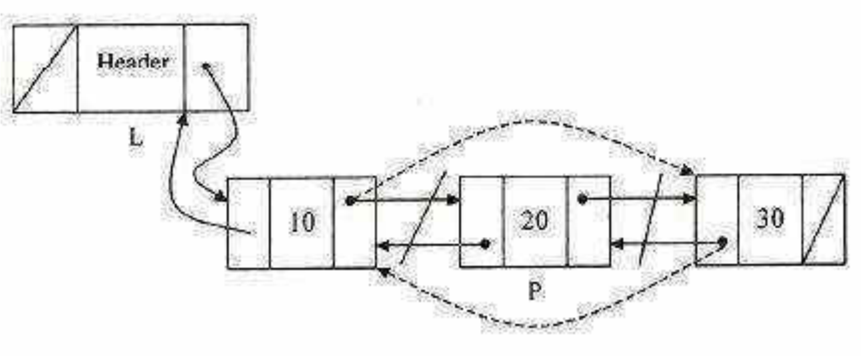

Routine to display the elements in the list:

```
  void Display( List L )
  {
    P = L -> next ;
  while ( p != NULL)
  {
      printf("%d", p -> data ;
      p = p -> next ;
  }
  printf(" NULL");
}
```

Routine to search whether an element is present in the list

```
void find()
{
int a,flag=0,count=0;
if(L==NULL)
printf("\nThe list is empty");
else
{
printf("\nEnter the elements to be searched");
scanf("%d",&a);
for(P=L;P!=NULL;P=P->next)
{
count++;
if(P->data==a)
{
flag=1;
printf("\nThe element is found");
printf("\nThe position is %d",count);
```

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```
break;
}
}
if(flag==0)
printf(“\nThe element is not found”);
}
}
```

Program 2: Implementation of Doubly linked list	Output

#include<stdio.h>
#include<conio.h>
void insert();
void deletion();
void display();
void find();
typedef struct node *position;
position newnode,temp,L=NULL,P;
struct node
{
int data;
 position next;
 position prev;
};
void main()
{
int choice;
clrscr();
do
{ printf(“\n1.INSERT”);
printf(“\n2.DELETE”);
printf(“\n3.DISPLAY”);
printf(“\n4.FIND”);
printf(“\n5.EXIT”);
printf(“\nEnter ur option”);
scanf(“%d”,&choice);
switch(choice)
{
case 1:
insert();
break;
case 2:
deletion();
break;
case 3:
display();
	1.INSERT
	2.DELETE
	3.DISPLAY
	4.FIND
	5.EXIT
	Enter ur option1
	
	Enter the data to be inserted10
	
	1.INSERT
	2.DELETE
	3.DISPLAY
	4.FIND
	5.EXIT
	Enter ur option1
	
	Enter the data to be inserted 20
	
	Enter the position where the data is to be inserted 2

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```
break;
case  4:
find();
break;
case  5:
exit(1);
}
}while(choice!=5);
getch();
}
void insert()
{
int pos,I;
newnode=(struct node*)malloc(sizeof(struct node));
printf("\nEnter the data to be inserted");
scanf("%d",&newnode->data);
if(L==NULL)
{
L=newnode;
L->next=NULL;
L->prev=NULL;
}
else
{
printf("\nEnter the position where the data is to be inserted");
scanf("%d",&pos);
if(pos==1)
{
newnode->next=L;
newnode->prev=NULL;
L->prev=newnode;
L=newnode;
}
else
{
P=L;
for(i=1;i<pos-1&&P->next!=NULL;i++)
{
P=P->next;
}
newnode->next=P->next;
P->next=newnode;
newnode->prev=P;
P->next->prev=newnode;
}
}
```

```
1.INSERT
2.DELETE
3.DISPLAY
4.FIND
5.EXIT
Enter ur option1

Enter the data to be
inserted 30

Enter the position where
the data is to be inserted3

1.INSERT
2.DELETE
3.DISPLAY
4.FIND
5.EXIT
Enter ur option 3

The elements in the list
are
10 20 30
1.INSERT
2.DELETE
3.DISPLAY
4.FIND
5.EXIT
Enter ur option 2
```

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```
}
void deletion()
{
int pos,I;
if(L==NULL)
printf("\nThe list is empty");
else
{
printf("\nEnter the position of the data to be deleted");
scanf("%d",&pos);

if(pos==1)
{ temp=L;
L=temp->next;
L->prev=NULL;
printf("\nThe deleted element is %d",temp->data);
free(temp);
}
else
{
P=L;
for(i=1;i<pos-1;i++)
P=P->next;
temp=P->next;
printf("\nThe deleted element is %d",temp->data);
P->next=temp->next;
temp->next->prev=P;
free(temp);
}
}
}
void display()
{
if(L==NULL)
printf("\nNo of elements in the list");
else
{
printf("\nThe elements in the listare\n");
for(P=L;P!=NULL;P=P->next)
printf("%d",P->data);
}
}
void find()
{
int a,flag=0,count=0;
```

```
Enter the position of the
data to be deleted 2

The deleted element is 20
1.INSERT
2.DELETE
3.DISPLAY
4.FIND
5.EXIT
Enter ur option 3

The elements in the list
are
10 30
1.INSERT
2.DELETE
3.DISPLAY
4.FIND
5.EXIT
Enter ur option4

Enter the elements to be
searched 20

The element is not found
1.INSERT
2.DELETE
3.DISPLAY
4.FIND
5.EXIT
Enter ur option 4
```

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```
if(L==NULL)
printf("\nThe list is empty");
else
{
printf("\nEnter the elements to be searched");
scanf("%d",&a);
for(P=L;P!=NULL;P=P->next)
{
count++;
if(P->data==a)
{
flag=1;
printf("\nThe element is found");
printf("\nThe position is %d",count);
break;
}
}
if(flag==0)
printf("\nThe element is not found");
}
}
```

```
Enter the elements to be searched 30

The element is found
The position is 2
1.INSERT
2.DELETE
3.DISPLAY
4.FIND
5.EXIT
Enter ur option5
Press any key to continue . . .
```

Advantages of DLL:

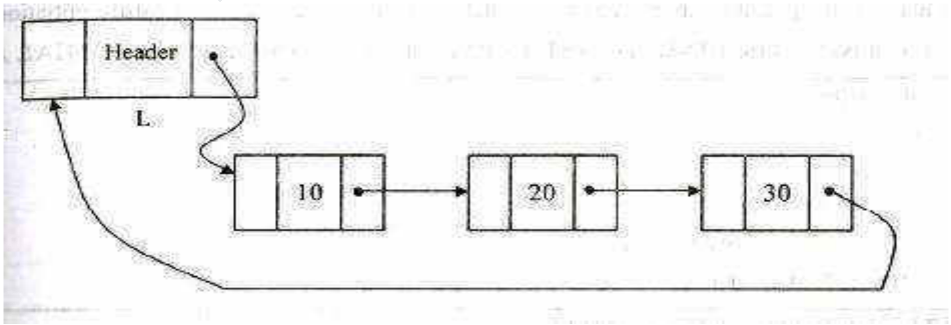
The DLL has two pointer fields. One field is prev link field and another is next link field. Because of these two pointer fields we can access any node efficiently whereas in SLL only one link field is there which stores next node which makes accessing of any node difficult.

Disadvantages of DLL:

The DLL has two pointer fields. One field is prev link field and another is next link field. Because of these two pointer fields, more memory space is used by DLL compared to SLL

CIRCULAR LINKED LIST:

Circular Linked list is a linked list in which the pointer of the last node points to the first node.



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