Data Structures Odyssey: Exploring the Foundations of Computing

Ex. No.: 02	Implementation of Doubly Linked List	Date:07/03/2024

Write a C program to implement the following operations on Doubly Linked List.

(i) Insertion

(ii) Deletion

(iii) Search

(iv) Display

Algorithm:

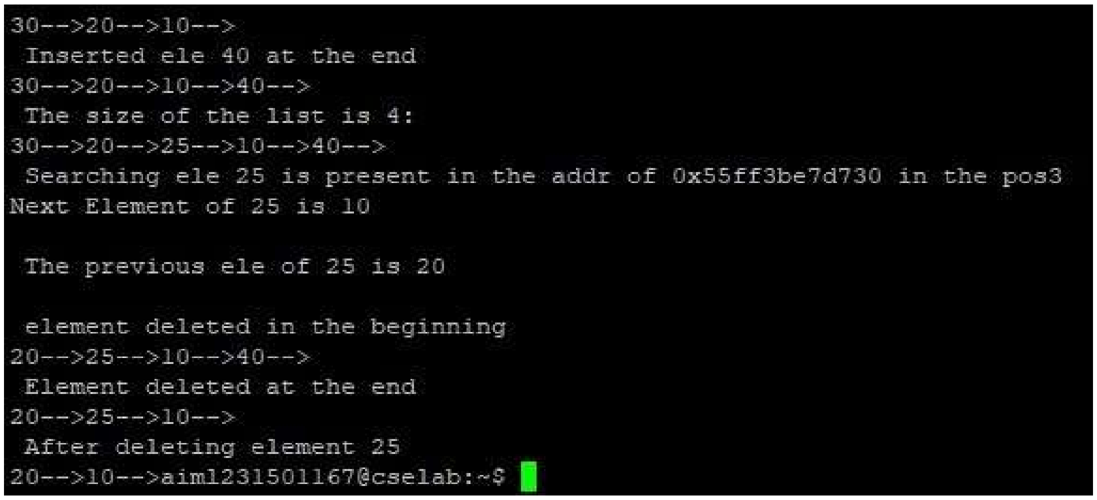
1) Start
2) Define a Node structure with data, a pointer to the previous Node, and a pointer to the next Node.
3) Initialize head and tail pointers to NULL. 4) Create functions for the following operations: a. Insert at the beginning or end:
- Create a new Node with the given data.
- Update the head or tail pointer accordingly.
5) Delete from the beginning or end:
- Update the head or tail pointer to the next or previous Node.
6) Search for a value:
- Traverse the list forward or backward and compare each Node's data with the given value.
- Return the Node if found, otherwise return NULL.
7) Test the operations by inserting, deleting, and searching for elements in the list. 8) Stop

PROGRAM:

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

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

struct node *newnode; struct
node *head = NULL;

void insertfront(int ele)
{
   newnode = (struct node *)malloc(sizeof(struct node));
   if (head == NULL)
   {
      newnode->data = ele;        newnode-
>next = NULL;        newnode->prev =
NULL;
      head = newnode;
   }
   else
   {
      newnode->data = ele;
newnode->next = head;
head->prev = newnode;        head
= newnode;
   }
}

void insertend(int ele)
{
   newnode = (struct node *)malloc(sizeof(struct node));
newnode->data = ele;     newnode->next = NULL;     if
(head != NULL)
   {
      struct node *t;
      t = head;
      while (t->next != NULL)
      {
         t = t->next;
      }
      newnode->prev = t;
      t->next = newnode;
   }




 else
   {
      newnode->prev = NULL;
      head = newnode;
   }
}

int listsize()
{    int c = 0;
struct node *t;
t = head;
   while (t != NULL)
   {       c++;
t = t->next;
   }
   printf("\n The size of the list is %d:\n", c);
   return c;
}

void insertpos(int ele, int pos)
{    int ls =
0;
   struct node *temp;
ls = listsize();     if
(head == NULL)
   {
      printf("\nInvalid position to insert a node\n");
return;
   }
   if (head != NULL && (pos <= 0 || pos > ls))
   {
      printf("\nInvalid position to insert a node\n");
return;
   }

   newnode = (struct node *)malloc(sizeof(struct node));

   if (newnode != NULL)
   {
      newnode->data = ele;
temp = head;        int
count = 1;
      while (count < pos - 1)
      {
         temp = temp->next;
count++;
      }
      if (pos == 1)
      {
         newnode->next = head;
head->prev = newnode;          head
= newnode;
      }

 else
      {
         newnode->next = temp->next;
if (temp->next != NULL)             temp-
>next->prev = newnode;          temp-
>next = newnode;          newnode-
>prev = temp;
      }
   }
}

void find(int s)
{    int c =
1;
   struct node *temp;
temp = head;
   if (head == NULL)
   {
      printf("\n List is empty");
   }
   else
   {
      while (temp->data != s && temp->next != NULL)
      {
         temp = temp->next;
         c++;
      }
      if (temp != NULL && temp->data == s)
      {
         printf("\n Searching ele %d is present in the addr of %p in the pos%d", temp->data,
temp, c);
      }
else
      {
         printf("\n Searching elem %d is not present", s);
      }
   }
}

void findnext(int s)
{
   struct node *temp;
temp = head;
   if (temp == NULL || temp->next == NULL)
   {
      printf("No next element ");
   }
   else
   {
      while (temp->data != s)
      {
         temp = temp->next;
      }
      printf("\nNext Element of %d is %d\n", s, temp->next->data);

  }
}

void findprev(int s)
{
   struct node *temp;
temp = head;
   if (temp == NULL)
   {
      printf("List is empty ");
   }
   else
   {
      while (temp->data != s)
      {
         temp = temp->next;
      }
      printf("\n The previous ele of %d is %d\n", s, temp->prev->data);
   }
}

void deleteAtBeginning()
{
   if (head == NULL)
   {
      printf("List is empty");
   }
   else
   {
      struct node *t = head;
head = head->next;       if
(head != NULL)
head->prev = NULL;
free(t);
   }
}

void deleteAtEnd()
{
   if (head == NULL)
   {
      printf("\n List is empty");
   }
   else
   {
      struct node *temp = head;
      while (temp->next != NULL)
      {
         temp = temp->next;
      }
      if (temp->prev != NULL)           temp->prev-
>next = NULL;
      free(temp);


}
}

void delete(int ele)
{
   struct node *t = head;
if (t->data == ele)
   {
      head = t->next;        if
(head != NULL)
head->prev = NULL;
free(t);
   }
   else
   {
      while (t->data != ele)
      {
         t = t->next;
      }
      if (t->next != NULL)           t->next-
>prev = t->prev;        t->prev->next =
t->next;
      free(t);
   }
}

void display()
{
   struct node *temp;
temp = head;     while
(temp != NULL)
   {
      printf("%d-->", temp->data);
      temp = temp->next;
   }
}

int main()
{
   insertfront(10);
insertfront(20);
insertfront(30);     display();
   printf("\n Inserted ele 40 at the end\n");
insertend(40);     display();     insertpos(25,
3);     display();     find(25);     findnext(25);
findprev(25);
```

```
  printf("\n element deleted in the beginning\n");
deleteAtBeginning();    display();

 deleteAtEnd();
  printf("\n Element deleted at the end\n");
display();
  printf("\n After deleting element 25\n");
delete(25);    display();    return 0;
}
```

OUTPUT:



```
30-->20-->10-->
 Inserted ele 40 at the end
30-->20-->10-->40-->
 The size of the list is 4:
30-->20-->25-->10-->40-->
 Searching ele 25 is present in the addr of 0x55ff3be7d730 in the pos3
Next Element of 25 is 10

 The previous ele of 25 is 20

 element deleted in the beginning
20-->25-->10-->40-->
 Element deleted at the end
20-->25-->10-->
 After deleting element 25
20-->10-->aiml231501167@cselab:~$
```

RESULT: **Thus, the program was successfully executed.**