VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
On

DATA STRUCTURES (23CS3PCDST)

Submitted by

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in partial fulfilment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING
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Bull Temple Road, Bengaluru-560019

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Department of Computer Science and Engineering

This is to certify that the Lab work entitled **"DATA STRUCTURES"** carried out by HEMANTH KUMAR R **(1BM23CS110)**, who is Bonafide student of **B. M. S. College of Engineering**. It is in partial fulfilment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2024-25. The Lab report has been approved as it satisfies the academic requirements in respect of Data structures Lab - **(23CS3PCDST)** work prescribed for the said degree.

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Index Sheet

Course outcomes:

CO1	Apply the concept of linear and nonlinear data structures.
CO2	Analyze data structure operations for a given problem
CO3	Design and develop solutions using the operations of linear and nonlinear data structure for a given specification.
CO4	Conduct practical experiments for demonstrating the operations of different data structures.

Lab program 1:

Write a program to simulate the working of stack using an array with the following: a) Push

b) Pop

c) Display

The program should print appropriate messages for stack overflow, stack underflow.

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

#define STACK_SIZE 5

int stack[STACK_SIZE];  int
top = -1;


void push(int item) {     if (top ==
STACK_SIZE - 1) {
printf("Stack overflow\n");
   } else {          stack[++top] = item;
printf("Item %d pushed to stack\n", item);
   }
}


int pop() {     if (top == -1) {
printf("Stack underflow\n");
       return -1;     } else {          printf("Item %d popped
from stack\n", stack[top]);
return stack[top--];
   }
}


void display() {     if (top == 1)
{         printf("Stack is
empty\n");
   } else {         printf("Stack contents:\n");
for (int i = 0; i
<= top; i++) {
printf("%d ", stack[i]);
       }
printf("\n");
   }
```

```
}

int main() {
   int choice, item;

   while (1) {
      printf("\n1: Push\n2: Pop\n3: Display\n4: Exit\n");        printf("Enter
your choice: ");
      scanf("%d", &choice);

      switch (choice) {           case
1:
            printf("Enter the item to push: ");
scanf("%d", &item);               push(item);
break;          case 2:             pop();
break;          case 3:             display();
break;          case 4:             exit(0);
default:              printf("Invalid
choice\n");
      }
   }

   return 0; }
```

Output:

```
1: Push
2: Pop
3: Display
4: Exit
Enter your choice: 1
Enter the item to push: 4
Item 4 pushed to stack

1: Push
2: Pop
3: Display
4: Exit
Enter your choice: 1
Enter the item to push: 3
Item 3 pushed to stack

1: Push
2: Pop
3: Display
4: Exit
Enter your choice: 1
Enter the item to push: 9
Item 9 pushed to stack

1: Push
2: Pop
3: Display
4: Exit
Enter your choice: 3
Stack contents:
4 3 9
```

Lab program 2:

WAP to convert a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide)WAP to convert a given valid

parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide)

```
#include<stdio.h>
#include<ctype.h>
char stack[100]; int
top=-1; void
push(char ele)  {
top++;
stack[top]=ele;
}  char
pop()
{     return
stack[(top)--];  }  int
pr(char op)  {
switch(op)
   {         case
'#':return 0;
break;        case
'(':return 1;
break;        case
'+':return 2;
break;        case
'':return 2;
break;        case
'*':return 2;
break;        case
'/':return 2;
break;
default:return 0;
break;
```

```
    }
} void
main()
{     char infix[100], postfix[100];
int i=0,count=0;     char ch;
//clrscr();     printf("Enter your infix
expression:");     scanf("%s",infix);
push('#');     while
(infix[i]!='\0')

    {         if
(isalpha(infix[i]))
        {
            postfix[count]=infix[i];
count++;
        }         else if(infix[i]
== '('                push(infix[i]);
else if(infix[i] == ')')            {
while (stack[top] != '('
            {
ch=pop();
postfix[count]=ch;                count++;
            }
            pop(); /* Removing the ( */
        }
else
        {
            while ((stack[top]!='#') && (pr(infix[i])<=pr(stack[top])))
            {
ch=pop();
postfix[count]=ch;                count++;
```

```
        }
push(infix[i]);
      }
i++;
   }
for(i=top;i!=0;i--)
   {       if (stack[i] == '(')          printf ("\n There was an issue
with the expression...");       ch=pop();       postfix[count]=ch;
count++;
   }

   for(i=0;i<count;i++)
   {
printf("%c",postfix[i]);
   }
}
```

```
PS E:\DSA\C> cd "e:\DSA\C\LAB-1\" ; if ($?) { gcc Lab2.c -o Lab2 } ; if ($?) { .\Lab2 }
Enter a valid infix expression: (A+B)*C
Postfix expression: AB+C*
PS E:\DSA\C\LAB-1>
```

Lab program 3:

3a)WAP to simulate the working of a queue of integers using an array. Provide the following operations: Insert, Delete, Display

The program should print appropriate messages for queue empty and queue overflow conditions

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

```
void insert(int q[], int *rear, int item, int QSIZE) {
if (*rear == QSIZE - 1) {         printf("Queue
overflow\n");
    } else {
        (*rear)++;
```

```
        q[*rear] = item;
    }
}

void delete(int *front, int *rear, int q[]) {
if (*front > *rear) {         printf("Queue
underflow\n");
    } else {         printf("Deleted item: %d\n", q[*front]);
        (*front)++;
    }
}

void display(int *front, int *rear, int q[]) {
if (*front == *rear) {         printf("Queue is
empty\n");
    } else {         printf("Queue elements:
");         for (int i = *front; i <= *rear; i++)
{             printf("%d ", q[i]);
        }
printf("\n");
    }
}

int main() {     int
QSIZE = 3;     int
q[QSIZE];     int
choice, item;     int
front = 0;     int rear =
-1;     while (1) {
printf("Enter your
choice: ");
scanf("%d",
```

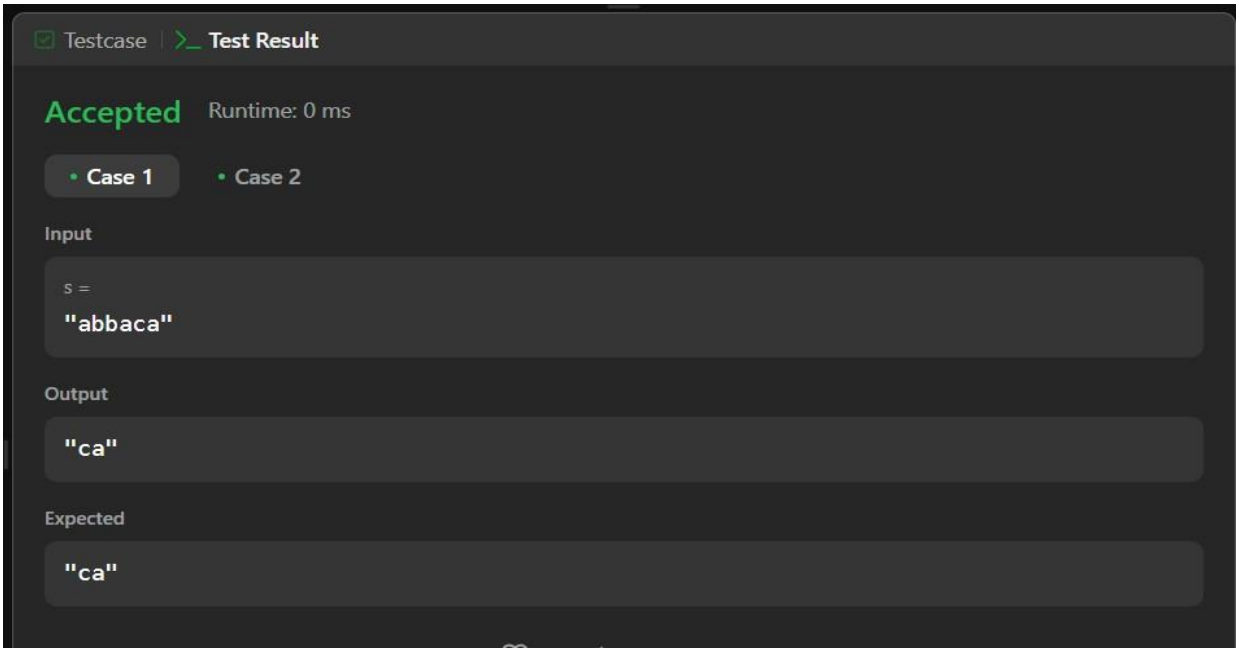
```
&choice);

        switch (choice) {
case 1:
                printf("Enter the item: ");
scanf("%d", &item);                 insert(q, &rear,
item, QSIZE);                 break;            case 2:
delete(&front, &rear,
q);                 break;            case 3:
display(&front, &rear, q);                 break;
default:
                printf("Invalid choice\n");
        }
}       return
0;
}
```

LEETCODE PROBLEM:

3b) Remove all adjacent duplicates in a string

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

```
char* removeDuplicates(char* s) {
    int len = strlen(s);     char* stack =
(char*)malloc(len + 1);     int top = -1;

    for (int i = 0; i < len; i++) {         if
(top >= 0 && stack[top] == s[i]) {
            top--;         } else {
stack[++top] = s[i];
        }
    }

    stack[top + 1] = '\0';
return stack;
}
```



3b)WAP to simulate the working of a circular queue of integers using an array. Provide the following operations: Insert, Delete & DisplayThe program should print appropriate messages for queue empty and queue overflow conditions. The program should be done using pass by reference only.

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

void insert(int q[], int *rear, int *count, int item, int QSIZE) {
if (*count >= QSIZE) {         printf("Queue overflow\n");
   } else {
       *rear = (*rear + 1) % QSIZE;
q[*rear] = item;
       (*count)++;
   }
}

int delete(int q[], int *front, int *count, int QSIZE) {
int deleted_item;     if (*count == 0) {
printf("Queue underflow\n");         return -1;     }
else {         deleted_item = q[*front];
       *front = (*front + 1) % QSIZE;
       (*count)--;
return deleted_item;
   }
}

void display(int q[], int *front, int *count, int QSIZE) {
   int i;
   if (*count == 0) {
printf("Queue is empty\n");
```

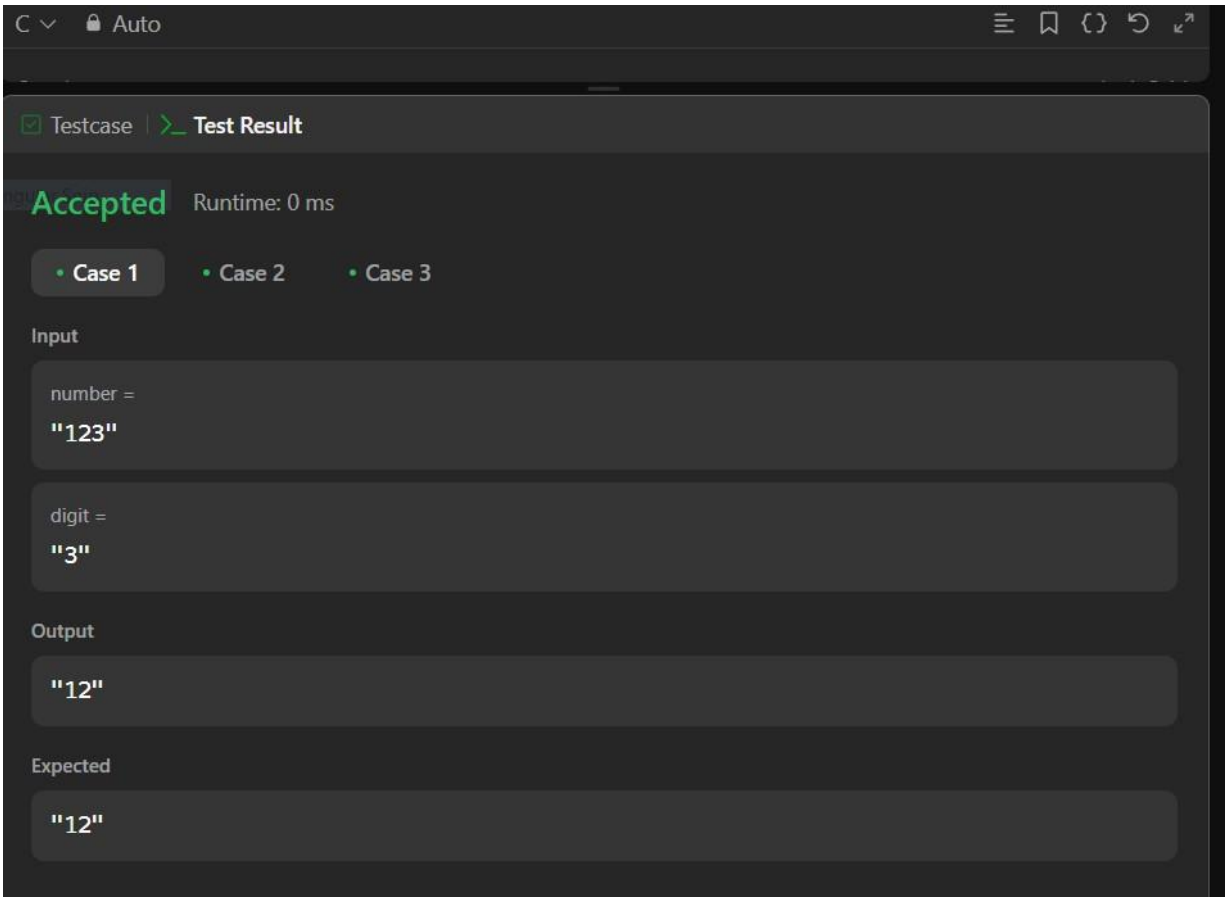
```
    } else {         printf("Queue elements: ");
for (i = *front; i < *front + *count; i++) {
printf("%d ", q[i % QSIZE]);
        }
printf("\n");
    }
}

int main() {     int count = 0;
int QSIZE = 3;     int q[QSIZE];
int choice, deleted_item, item;
int front = 0;     int rear = -1;

    while (1) {         printf("Enter your choice (1: Insert, 2: Delete,
3: Display): ");         scanf("%d", &choice);

        switch (choice) {
case 1:
            printf("Enter the item: ");
scanf("%d", &item);                 insert(q, &rear,
&count, item, QSIZE);
            break;
case 2:
            deleted_item = delete(q, &front, &count, QSIZE);
            if (deleted_item != -1) {
printf("Deleted item is %d\n", deleted_item);
            }
break;
case 3:
            display(q, &front, &count, QSIZE);
```

```
            break;
default:
            printf("Invalid choice\n");
        }
    }

    return 0;
}
```

LeetCode Program- Remove Digit from Number to Maximize Result

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

char* removeDigit(char* number, char digit) {
int len = strlen(number);     char* result =
(char*)malloc(len);     int maxIndex = -1;

    for (int i = 0; i < len; i++) {         if (number[i] ==
digit) {             if (i + 1 < len && number[i] <
number[i + 1]) {                 maxIndex = i;
break;
            }
            maxIndex = i;
        }
    }
```

```
    for (int i = 0, j = 0; i < len; i++) {
if (i != maxIndex) {
result[j++] = number[i];
        }
    }

    result[len - 1] = '\0';
return result;
}
```



Lab Program-4:

WAP to Implement Singly Linked List with following operations

a) Create a linked list.

b) Insertion of a node at first position, at any position and at end of list.

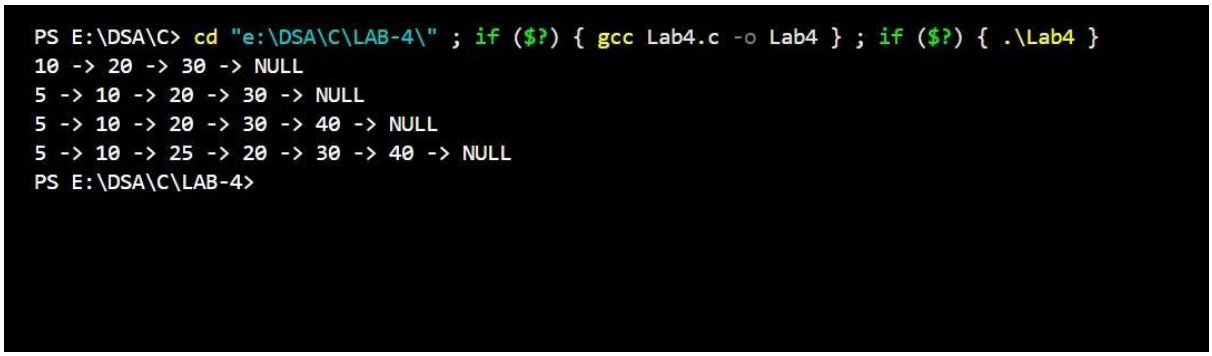
c) Display the contents of the linked list.

```
#include <stdio.h>

#include <stdlib.h>



struct Node {

   int data;     struct

Node* next; };



struct Node* head = NULL;



void createLinkedList(int data[], int n) {     for (int i = 0; i < n; i++) {

int value = data[i];          struct Node* newNode = (struct

Node*)malloc(sizeof(struct Node));         newNode->data = value;

newNode->next = NULL;


       if (head == NULL) {

head = newNode;

       } else {             struct Node* temp

=  head;             while (temp->next !=

NULL) {                temp = temp-

>next;

          }
```

```
            temp->next = newNode;
        }
    }
}


void insertAtBeginning(int data) {     struct Node* newNode = (struct
Node*)malloc(sizeof(struct Node));     newNode->data = data;     newNode-
>next = head;     head = newNode;
}


void insertAtEnd(int data) {     struct Node* newNode = (struct
Node*)malloc(sizeof(struct Node));     newNode->data = data;     newNode-
>next = NULL;

    if (head == NULL) {
head = newNode;
    } else {         struct Node* temp =
head;         while (temp->next !=
NULL) {             temp = temp-
>next;
        }
        temp->next = newNode;
    }
}


void insertAtPosition(int data, int position) {     struct Node* newNode =
(struct Node*)malloc(sizeof(struct Node));     newNode->data = data;
```

```
    if (position == 0) {         newNode-
>next = head;         head = newNode;
        return;
    }

    struct Node* temp = head;     for (int i = 0; temp !=
NULL && i < position - 1; i++) {         temp = temp-
>next;

    }

    if (temp == NULL) {
printf("Position out of bounds\n");
free(newNode);
    } else {          newNode->next =
temp->next;         temp->next =
newNode;
    }
}



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

int main() {     int data[] = {10, 20, 30};
int n = sizeof(data) / sizeof(data[0]);
```

```
    createLinkedList(data, n);
displayList();



    insertAtBeginning(5);
displayList();     insertAtEnd(40);
displayList();



    insertAtPosition(25, 2);
displayList();


    return 0;
}
```



Lab Program-5:

WAP to Implement Singly Linked List with following operations

a) Create a linked list.

b) Deletion of first element, specified element and last element in the list.

c) Display the contents of the linked list.

```
#include <stdio.h>

#include <stdlib.h>
```

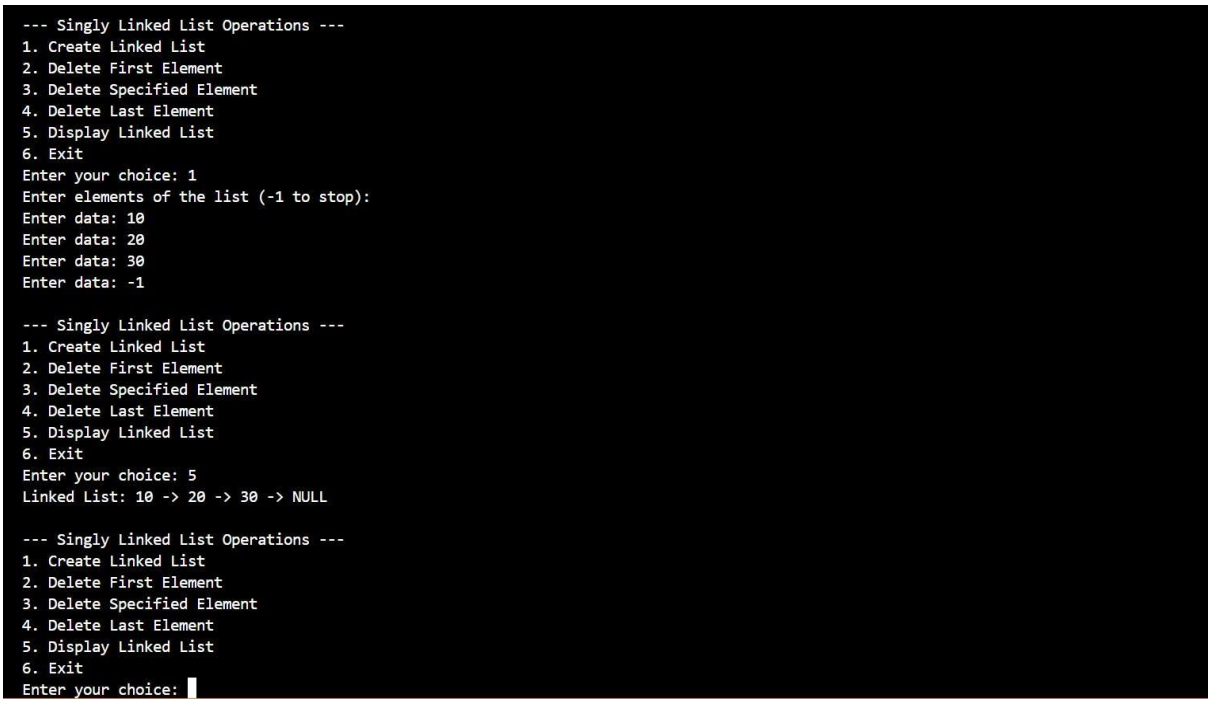
```
struct Node {
   int data;     struct
Node* next;
};

struct Node* createLinkedList(); void deleteFirst(struct
Node** head); void deleteSpecified(struct Node** head,
int value); void deleteLast(struct Node** head); void
displayLinkedList(struct Node* head);

int main() {     struct Node*
head = NULL;     int choice,
value;

   while (1) {         printf("\n--- Singly Linked List
Operations ---\n");         printf("1. Create Linked List\n");
printf("2. Delete First Element\n");         printf("3. Delete
Specified Element\n");         printf("4.
Delete Last Element\n");         printf("5. Display Linked
List\n");         printf("6. Exit\n");         printf("Enter your choice:
");         scanf("%d", &choice);
         switch (choice) {             case
1:
head = createLinkedList();
               break;             case
2:
deleteFirst(&head);                 break;             case 3:
printf("Enter the value to delete: ");
scanf("%d", &value);                 deleteSpecified(&head,
value);
```

```
            break;          case
4:
deleteLast(&head);              break;
case 5:
displayLinkedList(head);
            break;          case 6:
printf("Exiting program.\n");
            exit(0);
default:                printf("Invalid choice! Please try
again.\n");
        }
    }

    return 0;
}

struct Node* createLinkedList() {    struct Node *head = NULL,
*temp = NULL, *newNode = NULL;
    int data;

    printf("Enter elements of the list (-1 to stop):\n");    while
(1) {       printf("Enter data: ");       scanf("%d",
&data);       if (data == -1)          break;

        newNode = (struct Node*)malloc(sizeof(struct Node));       newNode->data
= data;

        newNode->next = NULL;

        if (head == NULL) {
head = newNode;
```

```
        } else {              temp-
>next = newNode;
        }
        temp = newNode;
    }      return
head;
}

void deleteFirst(struct Node** head) {     if (*head
== NULL) {         printf("List is empty. Nothing to
delete.\n");         return;
    }
    struct Node* temp = *head;
*head = (*head)->next;     free(temp);
printf("First element deleted.\n");
}

void deleteSpecified(struct Node** head, int value) {
if (*head == NULL) {         printf("List is empty. Nothing
to delete.\n");
        return;
    }

    struct Node *temp = *head, *prev = NULL;

    if (temp != NULL && temp->data == value) {
        *head            =            temp->next;
free(temp);               printf("Element  %d
deleted.\n", value);
        return;
    }
```

```
    while (temp != NULL && temp->data != value) {
prev = temp;         temp = temp->next;
    }

    if (temp == NULL) {         printf("Element %d not
found in the list.\n", value);          return;
    }

    prev->next = temp->next;     free(temp);
printf("Element %d deleted.\n", value);
}

void deleteLast(struct Node** head) {     if (*head
== NULL) {         printf("List is empty. Nothing to
delete.\n");         return;
    }

    struct Node *temp = *head, *prev = NULL;

    if (temp->next == NULL) {
*head = NULL;         free(temp);
        printf("Last element deleted.\n");
        return;
    }

    while (temp->next != NULL) {
prev = temp;         temp = temp-
>next;
    }
```

```
    prev->next = NULL;     free(temp);
printf("Last element deleted.\n");
}

void displayLinkedList(struct Node* head) {
if (head == NULL) {         printf("List is
empty.\n");         return;
    }

    printf("Linked List: ");     struct
Node* temp = head;     while
(temp != NULL) {         printf("%d ->
", temp->data);         temp = temp-
>next;
    }
    printf("NULL\n");
}
```



Lab Program-6:

6a) WAP to Implement Single Link List with following operations: Sort the linked list, Reverse the linked list, Concatenation of two linked lists.

```
#include<stdio.h>

#include<stdlib.h>


struct node

{     int data;

struct node

*next;


};

typedef struct node* NODE;


NODE getnode()

{

   NODE ptr;

ptr=(NODE)malloc(sizeof(struct node));

if(ptr==NULL)

   {         printf("node not

created");

return NULL;

   }

return ptr;

}
```

```
NODE insert_beg(NODE first,int item)
{
   NODE new_node;
new_node=getnode();     new_node-
>data=item;     new_node->next=NULL;
if(first==NULL)         return new_node;
new_node-
>next=first;     return new_node;
}

void display(NODE first)
{
   NODE temp;
if(first==NULL) {
       printf("Linked list is empty\n");
   }
temp=first;
while(temp!=NULL)
   {         printf("%d ",temp-
>data);
temp=temp->next;
   }
}

NODE reverse(NODE first)
{
   NODE current,temp;
current=NULL;
if(first==NULL)         return
NULL;
while(first!=NULL)
```

```
    {         temp=first;
first=first-
>next;        temp->next=current;        current=temp;

    }     return
current;
}

void sort(NODE first)
{
    NODE temp1,temp2;
temp1=first;
    //temp2=first->next; while(temp1-
>next!=NULL)
    {
        temp2=temp1->next;
while(temp2!=NULL)
        {
            if(temp1->data>=temp2->data)
            {                int x=temp1->data;
temp1>data=temp2->data;              temp2-
>data=x;
            }
            temp2=temp2->next;
        }
        temp1=temp1->next;
    }
}

NODE concatenate(NODE first1,NODE first2)
{
    NODE last1;     if(first1==NULL
```

```
&& first2==NULL)          return
NULL;           if(first1==NULL)
return first2;    if(first2==NULL)
return  first1;          last1=first1;
while(last1->next!=NULL)
last1=last1->next;
last1>next=first2;    return first1;
}

void main()
{
   NODE first1=NULL;
NODE first2=NULL;    int
choice,item,pos,value;    while(1)
   {
      printf("\nEnter your choice\n 1.insert\n 2.reverse\n 3.sort\n 4.concatenate\n 5.display\n");
scanf("%d",&choice);       switch(choice)
      {      case 1:         {          printf("Enter
the item:");                  scanf("%d",&item);
first1=insert_beg(first1,item);
first2=insert_beg(first2,item);             break;
          }         case 2:
{
first1=reverse(first1);
break;
          }
case 3:
          {
sort(first1);
break;
          }
case 4:
```

```
        {
            first1=concatenate(first1,first2);
break;
        }       case 5:
{
display(first1);
break;
        }       default:
{
printf("exiting\n");
exit(0);
        }
      }
   }
}
```

```
Enter your choice
 1.insert
 2.reverse
 3.sort
 4.concatenate
 5.display
1
Enter the item:3

Enter your choice
 1.insert
 2.reverse
 3.sort
 4.concatenate
 5.display
1
Enter the item:4

Enter your choice
 1.insert
 2.reverse
 3.sort
 4.concatenate
 5.display
2

Enter your choice
 1.insert
 2.reverse
 3.sort
 4.concatenate
 5.display
5
3 4
```

```
Enter your choice
 1.insert
 2.reverse
 3.sort
 4.concatenate
 5.display
3

Enter your choice
 1.insert
 2.reverse
 3.sort
 4.concatenate
 5.display
5
3 4
Enter your choice
 1.insert
 2.reverse
 3.sort
 4.concatenate
 5.display
4

Enter your choice
 1.insert
 2.reverse
 3.sort
 4.concatenate
 5.display
5
3 4 4 3
```

6b) WAP to Implement Single Link List to simulate Stack & Queue Operations.

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

struct node
{    int data;    struct node
*next;
};
typedef struct node* NODE;

NODE getnode()
{
   NODE ptr;
ptr=(NODE)malloc(sizeof(struct node));
if(ptr==NULL)
   {        printf("node not
created");
return NULL;
   }
return ptr;
}

NODE insert_end(NODE first,int item)
{
   NODE new_end,current;
new_end=getnode();    new_end->data=item;
new_end->next=NULL;
```

```
if(first==NULL)         return new_end;
current=first;     while(current-
>next!=NULL)         current=current-
>next;     current->next=new_end;
   return first;
}



NODE delete_end(NODE first)
{
   NODE prev,last;
if(first==NULL)
   {         printf("Linked list is
empty\n");
return NULL;
   }
   prev=NULL;
   last=first;     while(last-
>next!=NULL)
   {         prev=last;
last=last-
>next;
   }
   prev->next=NULL;
   free(last);     return
first;
}
```

```
void display(NODE first)
{
   NODE temp;
if(first==NULL)
   {        printf("Linked list is
empty\n");
   }
temp=first;
while(temp!=NULL)
   {
      printf(" %d ",temp->data);        temp=temp-
>next;
   }
}

void main()
{
   NODE first=NULL;    int
choice,item,pos,value;    while(1)
   {
      printf("\n Enter your choice\n 1.insert\n 2.delete\n 0.display\n");
scanf("%d",&choice);        switch(choice)
      {        case 1:            {
printf("Enter the item:");
scanf("%d",&item);
first=insert_end(first,item);
break;
         }        case 2:            {
first=delete_end(first);
break;
         }
case 0:
```

```
        {
display(first);                 break;
        }       default:
{
printf("exiting\n");
exit(0);
        }
      }
   }
}
```

```
 Enter your choice
 1.insert
 2.delete
 0.display
1
Enter the item:2

 Enter your choice
 1.insert
 2.delete
 0.display
1
Enter the item:4

 Enter your choice
 1.insert
 2.delete
 0.display
1
Enter the item:7

 Enter your choice
 1.insert
 2.delete
 0.display
2

 Enter your choice
 1.insert
 2.delete
 0.display
0
 2  4
```

Lab program-7:

WAP to Implement doubly link list with primitive operations

a) Create a doubly linked list.

b) Insert a new node to the left of the node.

c) Delete the node based on a specific value

d) Display the contents of the list

```
#include <stdio.h>

#include <stdlib.h>

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

struct Node* createNode(int val) {     struct Node* n = (struct
Node*)malloc(sizeof(struct Node));     n->data = val;     n->prev = n->next
= NULL;     return n;
}

void insertEnd(struct Node** head, int val) {     struct
Node* n = createNode(val);
   if (!*head) {
*head = n;         return;
   }
   struct Node* t = *head;
while (t->next) t = t->next;     t-
>next = n;     n->prev = t;
}

void insertLeft(struct Node** head, int target, int val) {
struct Node* t = *head;     while (t && t->data != target) t
= t->next;     if (!t) return;
   struct Node* n = createNode(val);     n->next
= t;     n->prev = t->prev;
```

```
    if (t->prev) t->prev->next = n;
else *head = n;     t->prev = n;
}

void deleteNode(struct Node** head, int val) {
struct Node* t = *head;     while (t && t->data !=
val) t = t->next;     if (!t) return;     if (t->prev)
t>prev->next = t->next;     else *head = t->next;
if (t->next) t->next->prev = t->prev;     free(t);
}

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

int main() {     struct Node*
dll = NULL;

    insertEnd(&dll, 10);     insertEnd(&dll,
20);     insertEnd(&dll, 30);
printf("Doubly Linked List: ");
display(dll);

    insertLeft(&dll, 20, 15);     printf("After
Inserting 15 to the left of 20: ");     display(dll);  deleteNode(&dll, 10);     printf("After Deleting 10: ");
display(dll);

    return 0;
```

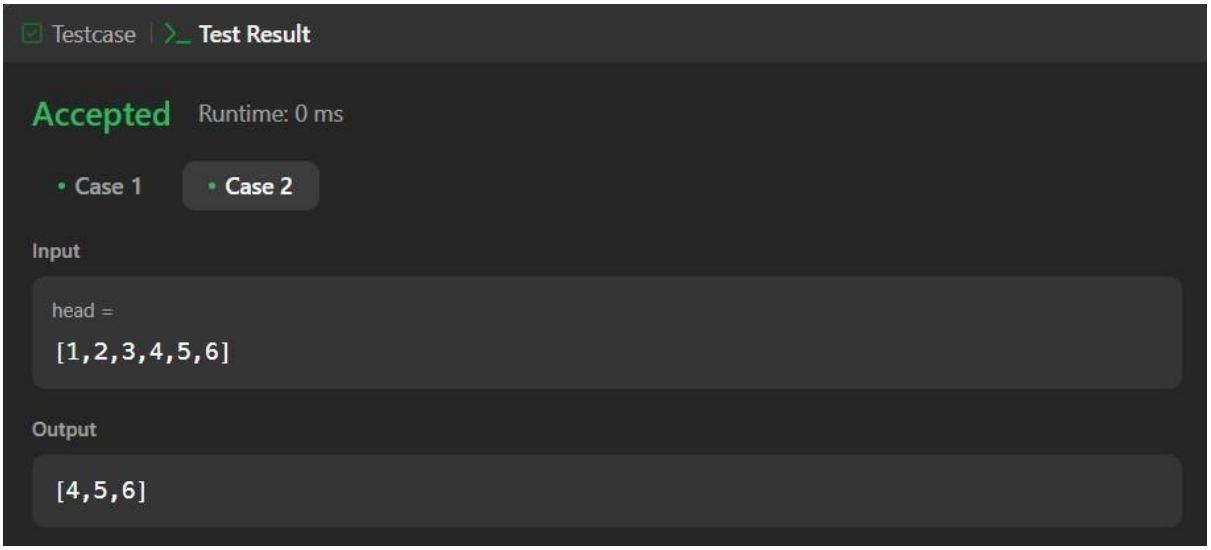
}

```
PS E:\DSA\D> cd "e:\DSA\D\LAB-7\" ; if ($?) { gcc Lab-7.c -o Lab-7 } ; if ($?) { .\Lab-7 }
Doubly Linked List: 10 <-> 20 <-> 30 <-> NULL
After Inserting 15 to the left of 20: 10 <-> 15 <-> 20 <-> 30 <-> NULL
After Deleting 10: 15 <-> 20 <-> 30 <-> NULL
PS E:\DSA\D\LAB-7>
```

Leetcode Program-

```
#include <stdio.h>

#include <stdlib.h>


struct ListNode {

   int val;

   struct       ListNode*

next;

};


struct           ListNode*

middleNode(struct ListNode*

head) { struct

  ListNode*


slow = head;     struct

ListNode* fast

= head;
```

```
    while (fast != NULL
&&          fast->next
   != NULL) {
slow        =
   slow-
>next;       fast = fast-
>next-
>next;
    }


    return slow;
}
```



Lab program-8: Write

a program

a) To construct a binary Search tree.

b) To traverse the tree using all the methods i.e., in-order, preorder and post order.

c) To display the elements in the tree.

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

```
struct BST {
   int data;     struct
BST *left;     struct
BST *right;
};

typedef struct BST* NODE;

NODE create()
{
   NODE temp;     temp =
(NODE)malloc(sizeof(struct BST));     printf("Enter
the item: ");     scanf("%d",
&temp->data);     temp->left = temp->right =
NULL;     return temp;
}

void insert(NODE root, NODE temp)
{     if (root->data < temp-
>data)
   {         if (root->right !=
NULL)            insert(root-
>right, temp);         else
root->right = temp;
   }
   else     {         if (root-
>left != NULL)
insert(root->left, temp);
else            root->left = temp;
   }
```

```
}

void preorder(NODE root)
{     if (root !=
NULL)
   {         printf("%d ", root-
>data);         preorder(root-
>left);         preorder(root-
>right);
   }
}

void inorder(NODE root)
{     if (root !=
NULL)
   {         inorder(root-
>left);         printf("%d ",
root->data);
inorder(root->right);
   }
}

void postorder(NODE root)
{     if (root !=
NULL)
   {
      postorder(root->left);
postorder(root->right);         printf("%d
", root->data);
   }
}
```

```
int main()
{
   NODE root = create();
NODE temp;
   int choice;

   while (1)
   {
      printf("\nEnter your choice\n1. Insert\n2. Preorder\n3. Inorder\n4. Postorder\n5. Exit\n");        scanf("%d",
&choice);

      switch(choice)
      {
case 1:
            temp = create();
insert(root, temp);               break;
case 2:               printf("Preorder
traversal: ");              preorder(root);
printf("\n");              break;
case 3:               printf("Inorder
traversal: ");              inorder(root);
printf("\n");              break;

          case 4:
             printf("Postorder traversal: ");
postorder(root);              printf("\n");              break;
case 5:              exit(0);            default:
printf("Invalid choice! Please try again.\n");
      }
   }
```

```
    return 0;
}
```

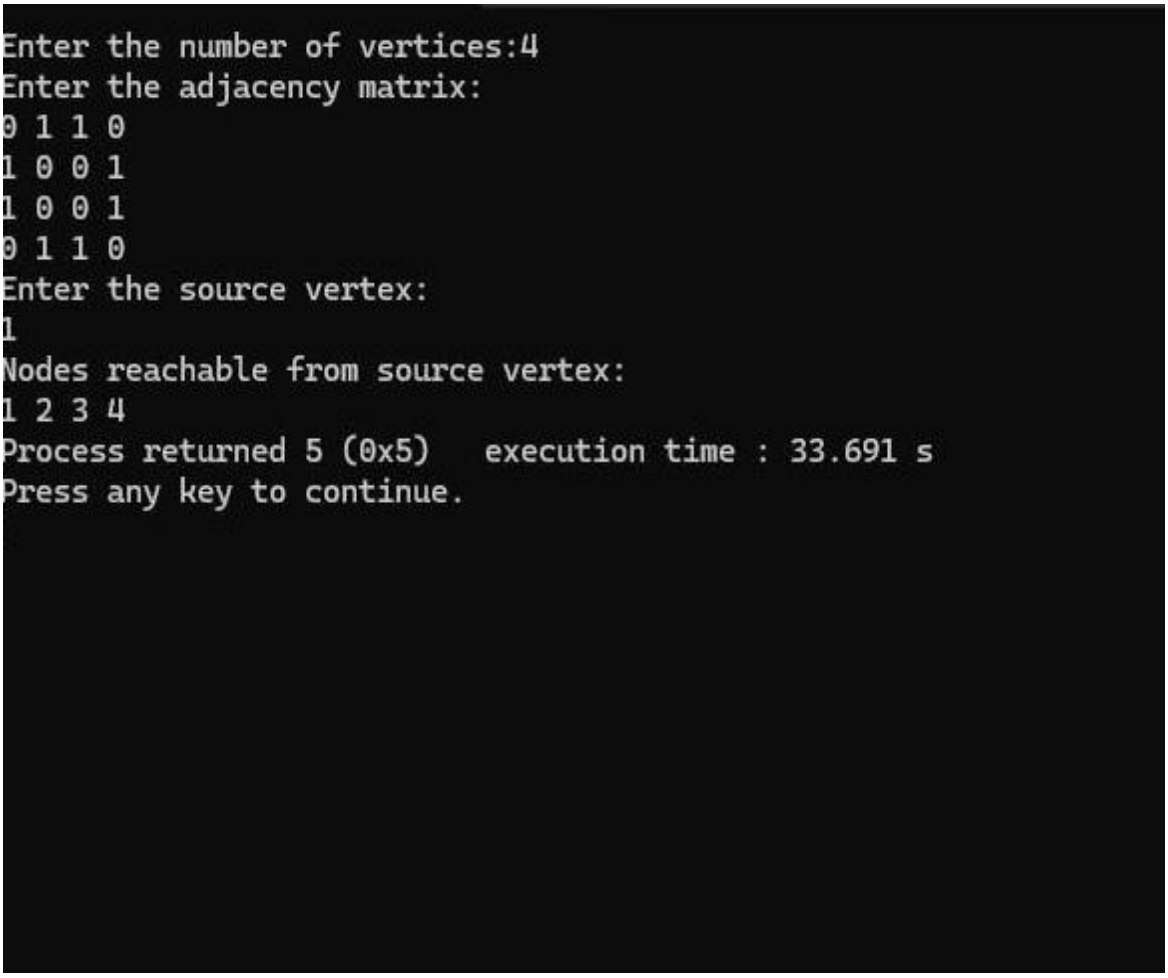
```
Enter the number of elements to insert in the BST: 4
Enter the elements:
10
20
30
40

In-order Traversal: 10 20 30 40
Pre-order Traversal: 10 20 30 40
Post-order Traversal: 40 30 20 10
PS E:\DSA\D\LAB-8>
```

LAB PROGRAM 9-

9a) Write a program to traverse a graph using BFS method.

```
#include<stdio.h> void
bfs(int); int a[10][10],vis[10],n;


void main()
{   int
i,j,src;


  printf("enter the number of vertices\n");
scanf("%d",&n);   printf("enter the adjacency
matrix\n");   for(i=1;i<=n;i++)

  {
for(j=1;j<=n;j++)
    {
        scanf("%d",&a[i][j]);


    }
```

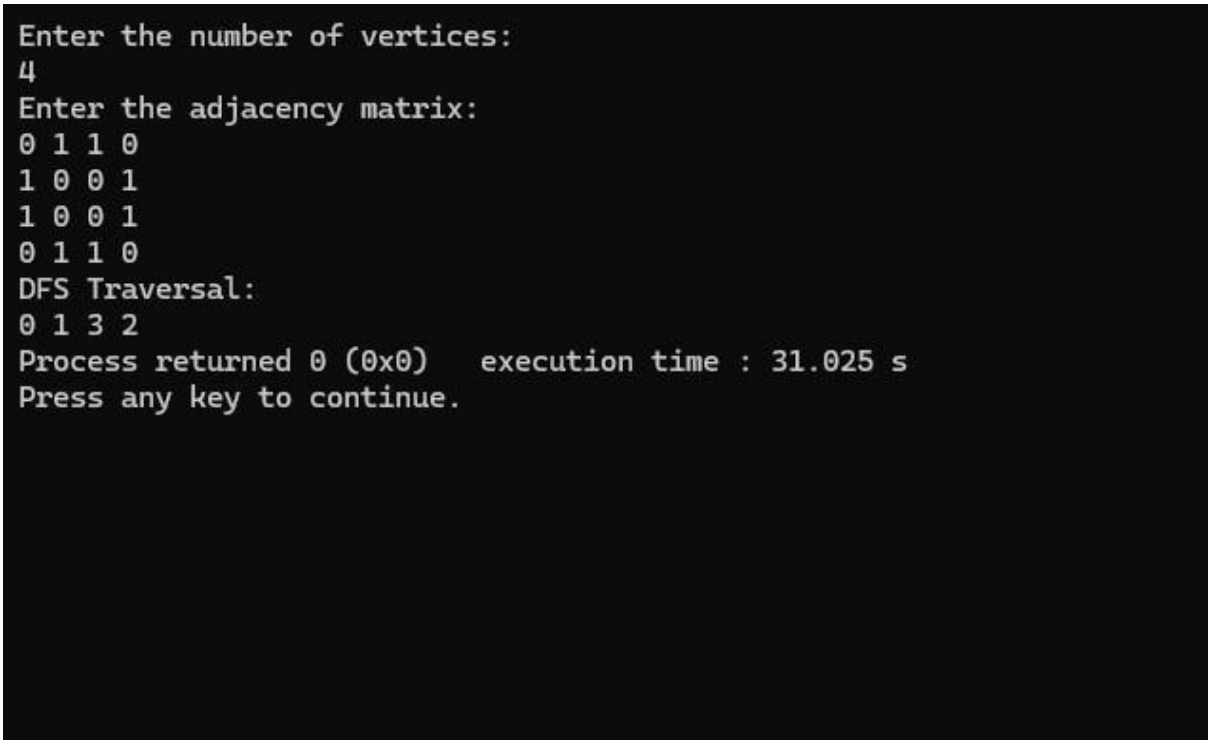
```
    vis[i]=0;
  }

  printf("enter the src vertex\n");
scanf("%d",&src);    printf("nodes reachable from
src vertex\n");    bfs(src);

}

void bfs(int v)
{    int
q[10],f=1,r=1,u,i;
q[r]=v;    vis[v]=1;
while(f<=r)
   {       u=q[f];
printf("%d ",u);
for(i=1;i<=n;i++)
      {
            if(a[v][i]==1 && vis[i]==0)
             {
       vis[i]=1;       r=r+1;

q[r]=i;
             }
      }
f=f+1;     }

}
```



9b) Write a program to check whether given graph is connected or not using DFS method.

```
#include<stdio.h> #include<conio.h>  int
i,j,n,a[10][10],vis[10]; void
dfs(int v)  {
vis[v]=1;
printf("%d ",v);
for(j=1;j<=n;j++)
   {
      if(a[v][j]==1&&vis[j]==0)
      {          dfs(j);
      }
   }
}  void
main()  {
```

```
printf("Ent
er the no of
vertices:");
scanf("%d"
,&n);
printf("Ent
er the
adjacency
matrix");
for(i=1;i<=
n;i++)
   {
for(j=1;j<=n;j++)
      {
         scanf("%d",&a[i][j]);
      }
vis[i]=0;
   }     printf("dfs
traversal");
for(i=1;i<=n;i++)
   {
if(vis[i]==0)
dfs(i);     }
getch();
}
```



Lab Program-10

Given a File of N employee records with a set K of Keys(4-digit)

which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are integers. Design and develop a Program in C that uses Hash function H: K-> L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

```
#include <stdio.h>

#include <stdlib.h>


int key[20], n, m;

int *ht, index; int

count = 0;


void insert(int key) {     index

= key % m;     while (ht[index]

!= -1) {         index = (index +

1) % m;

    }      ht[index]

= key;
```

```
count++;
}

void display() {     if (count == 0) {
printf("\nHash Table is empty");
        return;
    }
    printf("\nHash Table contents are:\n");     for
(int i = 0; i < m; i++) {         printf("\nT[%d] --
> %d", i, ht[i]);
    }
}

void main() {     printf("\nEnter the number of employee
records (N): ");     scanf("%d", &n);

    printf("\nEnter the two-digit memory locations (m) for hash table: ");     scanf("%d",
&m);

    ht = (int *)malloc(m * sizeof(int));
for (int i = 0; i < m; i++)          ht[i] = -
1;

    printf("\nEnter the four-digit key values (K) for %d Employee Records:\n", n);
    for (int i = 0; i < n; i++)
scanf("%d", &key[i]);

    for (int i = 0; i < n; i++) {
if (count == m) {
printf("\nHash table is full.
Cannot insert record %d key",
i + 1);
```

```
            break;
}
insert(key[i]);
    }

    display();
free(ht);
}
```