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LAB REPORT
on

Data Structures using C

Submitted by

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in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
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CERTIFICATE

This is to certify that the Lab work entitled "**Data Structures using C**" carried out by **SETU MISHRA (1BM22CS250),** who is bonafide student of **B.M.S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the academic semester December-2023 to March-2024. The Lab report has been approved as it satisfies the academic requirements in respect of a **Data Structures using C (23CS3PCDST)** work prescribed for the said degree.

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Course Outcome

CO	Apply the concept of linear and nonlinear data structures.
1	Analyse data structure operations for a given problem.
CO	CO3 Design and implement operations of linear and nonlinear data structure.
2	Conduct practical experiments for demonstrating the operations of different data structures and sorting techniques.
CO	
3	
CO	
4	

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>  #define
n 5
int stac[n];
int top=-1;


void push(){
if( top>=n){
      printf("stack is full, overflow\n");
return;
}
top++;
```

```
int item;
   printf("enter the number to be inserted\t");
scanf("%d",&item);
stac[top]=item;
}
void pop(){
if( top==-1){
      printf("stack is empty, underflow\n");
return;
}
int data=stac[top];
   printf("removing the %d element\t",top);
printf("removing %d\n",data);
top--;
}
void display(){
int i;
printf("the given stac is :\n");
for(i=top;i>=0;i--){
printf("%d\t",stac[i]);
}
}

int main()
```

```
{
int c;
while(1){
        printf("enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting\n");
printf("enter your choice\t");
scanf("%d",&c);
if(c==1){
push();
}
else if(c==2){
pop();
}
else if(c==3){
display();
}
else if(c==4) {
printf("Exiting!");
exit(0);
}else{
printf("Invalid choice,please enter a valid choice!\n");
}
}
return 0;
```

}

```
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       1
enter the number to be inserted 12
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       1
enter the number to be inserted 23
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       1
enter the number to be inserted 34
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       1
enter the number to be inserted 56
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       1
enter the number to be inserted 89
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       1
enter the number to be inserted 34
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       1
stack is full, overflow
```

```
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       2
removing the 5 element  removing 34
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       2
removing the 4 element  removing 89
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       2
removing the 3 element  removing 56
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       2
removing the 2 element  removing 34
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       2
removing the 1 element  removing 23
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       2
removing the 0 element  removing 12
enter 1 for push, 2 for pop and 3 for displaying the stack and 4 for exiting
enter your choice       2
stack is empty, underflow
```

Program 2:

2)WAP to convert a given valid parenthesized infix arithmetic expression to postfixexpression.Theexpressionconsistsofsinglecharacter operands and the binary operators + (plus), - (minus), * (multiply) and / (divide)

```
#include<stdio.h>
#include<ctype.h>
#include<string.h
>
#include<stdlib.h>
#define MAX 100

char
st[MAX];    int
top = -1;
void push (char st[], char);
char pop (char st[]);
void    InfixtoPostfix    (char    source[],    char
target[]); int getpri (char);

int
main ()
{
char infix[100], postfix[100];
printf ("Enter any infix expression:\n");
```

```
 gets (infix);
 strcpy (postfix, "");
 InfixtoPostfix (infix, postfix);
 printf ("The corresponding postfix expression
 is:\n"); puts (postfix);

return  0;
}

void
InfixtoPostfix (char source[], char
target[]) {
inti=0,j=0;
char temp;
strcpy (target, "");

 while (source[i] != '\0')
 {
 if (source[i] == '(')
 {
          push (st, source[i]);
 i++;
 }
   else if (source[i] == ')')
 {
```

```
while ((top != -1) && (st[top] != '('))
{
target[j] = pop (st);
j++;
}
if (top == -1 || st[top] != '('
{
printf ("\nIncorrect expression");
exit (1);
}
temp = pop (st);
i++;
}
else if (isdigit (source[i]) || isalpha (source[i]))
{
target[j] = source[i];
j++;
i++;
}
else if (source[i] == '+' || source[i] == '-' || source[i] == '*'
|| source[i] == '/' || source[i] == '^')
{
while ((top != -1) && (st[top] != '('
&& (getpri (st[top]) >= getpri (source[i])))

        {
```

```
    target[j] = pop (st);
    j++;
    }
    push (st, source[i]);
    i++;
    }
    else
    {
        printf ("\nIncorrect element in expression");
    exit (1);
    }
  }

while ((top != -1) && (st[top] != '('))
{
target[j] = pop (st);
j++;
}
target[j] = '\0';
}

int
getpri      (char
op) {
if (op == '^')
```

```
  return 2;
  else if ((op == '/') || (op == '*'))
  return 1;
  else if ((op == '+') || (op == '-'))
  return 0;
  else
  return -1;
}

void
push (char st[], char val)
{
if (top == MAX - 1)
{
     printf ("\n Stack overflow");
}
else
{
top++;
st[top] = val;
}

}

char
pop (char st[])
```

```
{
char val = ' ';
if (top == -1)
   printf ("\nStack underflow");
else
{
val = st[top];
top--;
}
return val;
}
```

```
Enter any infix expression:
(a+(b*c/d)^e-f
The corresponding postfix expression is:
abc*d/e^+f-
```

```
Enter any infix expression:
(a*(b+c/(d+e)^f))
The corresponding postfix expression is:
abcde+f^/+*
```

Program 3:

3)a)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>


#define MAX_SIZE 5


int  queue[MAX_SIZE];

int  front  =  -1,  rear  =

-1;

void insert(int value) {

if (rear == MAX_SIZE - 1) {

printf("Queue Overflow\n");

} else {

if (front == -1)

front = 0;

rear++;

queue[rear] = value;

      printf("%d inserted into the queue\n", value);

}
```

```
}

void delete() {
if (front == -1 || front > rear) {
printf("Queue Underflow\n");
} else {
      printf("%d deleted from the queue\n", queue[front]);
front++;
   }
}

void display() {
   if (front == -1 || front > rear) {
printf("Queue is empty\n");
} else {
printf("Queue elements: ");
      for (int i = front; i <= rear; i++)
printf("%d ", queue[i]);
printf("\n");
}

}

int main() {
   int choice, value;
```

```
do{
printf("1. Insert\n");
printf("2. Delete\n");
printf("3. Display\n");
printf("4. Exit\n");
   printf("Enter your choice: ");
scanf("%d", &choice);

   switch (choice) {
   case 1:
         printf("Enter the value to be inserted: ");
   scanf("%d", &value);
   insert(value);
   break;
   case 2:
   delete();
   break;
   case 3:
   display();
   break;
   case 4:
   printf("Exiting...\n");
   break;
   default:
   printf("Invalid choice\n");
```

```
    }
    } while (choice != 4);

    return 0;
}
```

```
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter the value to be inserted: 12
12 inserted into the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter the value to be inserted: 13
13 inserted into the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter the value to be inserted: 14
14 inserted into the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter the value to be inserted: 15
15 inserted into the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter the value to be inserted: 16
16 inserted into the queue
1. Insert
```

```
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter the value to be inserted: 16
16 inserted into the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter the value to be inserted: 34
Queue Overflow
```

```
Enter your choice: 2
12 deleted from the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 2
13 deleted from the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 2
14 deleted from the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 2
15 deleted from the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 2
16 deleted from the queue
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 2
Queue Underflow
```

3)b)WAP to simulate the working of a circular 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>

#define MAX_SIZE 5

int queue[MAX_SIZE];
int front = -1, rear =
-1;
// Function to check if the queue is
empty int isEmpty() {
return front == -1 && rear == -1;
}

// Function to check if the queue is full
int isFull() {
   return (rear + 1) % MAX_SIZE == front;
}

// Function to insert an element into the circular
queue void insert(int item) {
```

```
    if (isFull()) {
        printf("Queue Overflow: Cannot insert element %d\n", item);
    return;
    }

    if (isEmpty()) {
    front = rear = 0;
    } else {
        rear = (rear + 1) % MAX_SIZE;
    }

queue[rear] = item;
    printf("Element %d inserted successfully\n", item);
}

// Function to delete an element from the circular queue
void delete() {
if (isEmpty()) {
        printf("Queue Underflow: Cannot delete from an empty queue\n");
return;
    }

    printf("Element %d deleted successfully\n", queue[front]);

    if (front == rear) {
```

```
    front = rear = -1;
    } else {
        front = (front + 1) % MAX_SIZE;
    }
}

// Function to display the elements of the circular
queue void display() {
if (isEmpty()) {
printf("Queue is empty\n");
return;
    }

    printf("Elements in the queue: ");
    int i = front;
    do{
    printf("%d ", queue[i]);
    i = (i + 1) % MAX_SIZE;
    } while (i != (rear + 1) % MAX_SIZE);

    printf("\n");
}

 int main() {
    insert(1);
```

```
insert(2);
insert(3);
insert(4);
insert(5);

// Uncomment the line below to test queue overflow condition // insert(6);

display();

delete()
;
delete()
;
delete()
;
// Uncomment the line below to test queue underflow condition // delete();

display();

insert(6);
insert(7);

display();

return 0;
```

}

```
Element 1 inserted successfully
Element 2 inserted successfully
Element 3 inserted successfully
Element 4 inserted successfully
Element 5 inserted successfully
Elements in the queue: 1 2 3 4 5
Element 1 deleted successfully
Element 2 deleted successfully
Element 3 deleted successfully
Elements in the queue: 4 5
Element 6 inserted successfully
Element 7 inserted successfully
Elements in the queue: 4 5 6 7
```

```
Element 10 inserted successfully
Element 20 inserted successfully
Element 30 inserted successfully
Element 40 inserted successfully
Element 50 inserted successfully
Elements in the queue: 10 20 30 40 50
Element 10 deleted successfully
Element 20 deleted successfully
Element 30 deleted successfully
Elements in the queue: 40 50
Element 60 inserted successfully
Element 77 inserted successfully
Elements in the queue: 40 50 60 77


...Program finished with exit code 0
Press ENTER to exit console.
```

Program 4:

4a) 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.

Display the contents of the linked list.

```
#include
<stdio.h>
#include<stdlib.h
>
typedef struct Node {
int data;
    struct Node *next;
}Node;

void InsertAtBeginning( Node **head_ref,int
new_data); void InsertAtEnd( Node **head_ref,int
new_data);
void Insert( Node **prev_node,int new_data,int pos);
void PrintList(Node * next);
void InsertAtBeginning( Node **head_ref,int new_data)
{
   Node *new_node=(struct Node*)malloc(sizeof( Node));
```

```
    new_node->data=new_data;
   new_node->next=*head_ref;
*head_ref=new_node;
}

void InsertAtEnd(Node **head_ref,int new_data)
{
   Node *new_node=(struct Node*)malloc(sizeof( Node));
Node *last=*head_ref;
new_node->data=new_data;
new_node->next=NULL;
if (*head_ref==NULL)
{
*head_ref=new_node;
return ;
}
while (last->next!=NULL)
last=last->next;
last->next=new_node;


}

void   Insert(Node   **head_ref,int   new_data,int
pos) {
if (*head_ref ==NULL)
```

```
   {
   printf("Cannot beNULL\n");
   return;
   }
   Node *temp = *head_ref;
   Node *newNode = ( Node *) malloc (sizeof (
   Node)); newNode->data = new_data;
   newNode->next = NULL;


    while (--pos>0)
    {
    temp = temp->next;
    }
      newNode->next = temp->next;
    temp->next = newNode;
}



void PrintList(Node *node)
{
while (node!=NULL)
{
      printf("%d\n",node->data);
node=node->next;
}
```

```
}


int main()
{
int ch,new,pos;
Node* head=NULL;
while(ch!=5)
{
printf("Menu\n");
printf("1.Insert at beginning\n");
printf("2.Insert at a specific position\n");
printf("3.Insert at end\n");
printf("4.Display linked list\n");
printf("5.Exit\n");
printf("Enter your choice\n");
scanf("%d",&ch);
switch(ch)
{
case 1:
{
      printf("Enter the data you want to insert at beginning\n");
scanf("%d",&new);
InsertAtBeginning(&head,new);
break;
```

```
}
case 2:
{
printf("Enter the data and position at which you want to insert
\n"); scanf("%d%d",&new,&pos);
Insert(&head,new,pos);
break;
}
case 3:
{
printf("Enter the data you want to insert at end\n");
scanf("%d",&new);
InsertAtEnd(&head,new);
break;
}
case 4:
{
printf("Created linked list is:\n");
PrintList(head);
break;
}
case 5:
{
return 0;
break;
```

```
}
case 6:
{
        printf("Invalid data!");
break;
}
}
}
return 0;
}
```

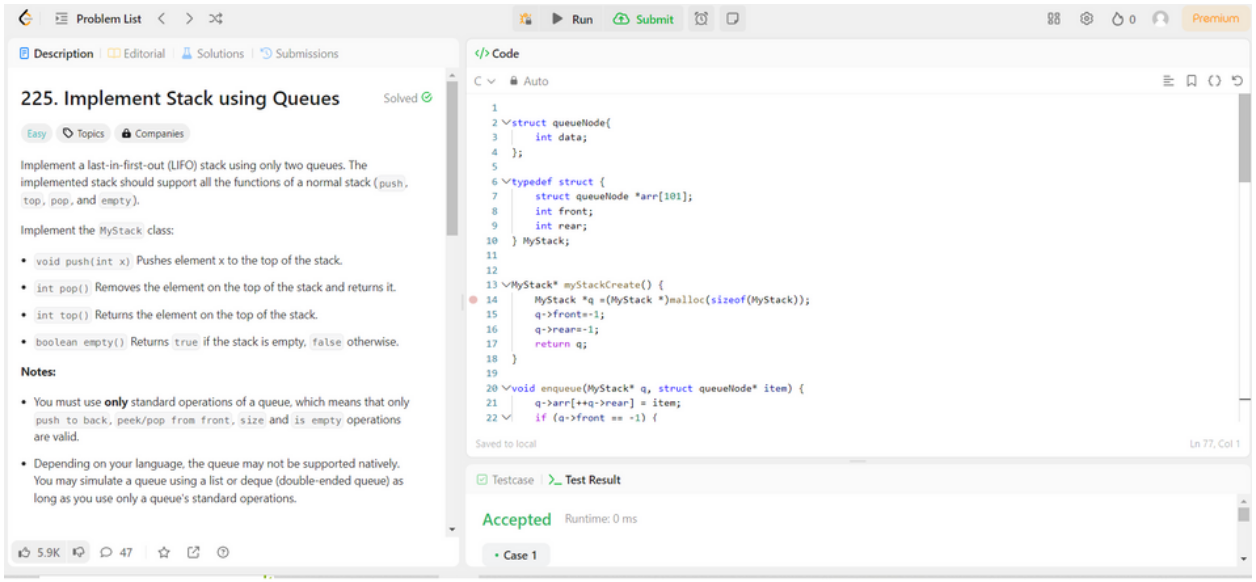
```
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
1
Enter the data you want to insert at beginning
12
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
1
Enter the data you want to insert at beginning
23
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
3
Enter the data  you want to insert at end
34
```

```
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
2
Enter the data and position at which you want to insert
99 1
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
4
Created linked list is:
23
99
12
34
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
5


...Program finished with exit code 0
Press ENTER to exit console.
```

```
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
1
Enter the data you want to insert at beginning
1
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
1
Enter the data you want to insert at beginning
2
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
3
Enter the data  you want to insert at end
4
```

```
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
2
Enter the data and position at which you want to
7
1
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
4
Created linked list is:
2
7
1
4
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
5


...Program finished with exit code 0
Press ENTER to exit console.
```

4)b) Program - Leetcode platform

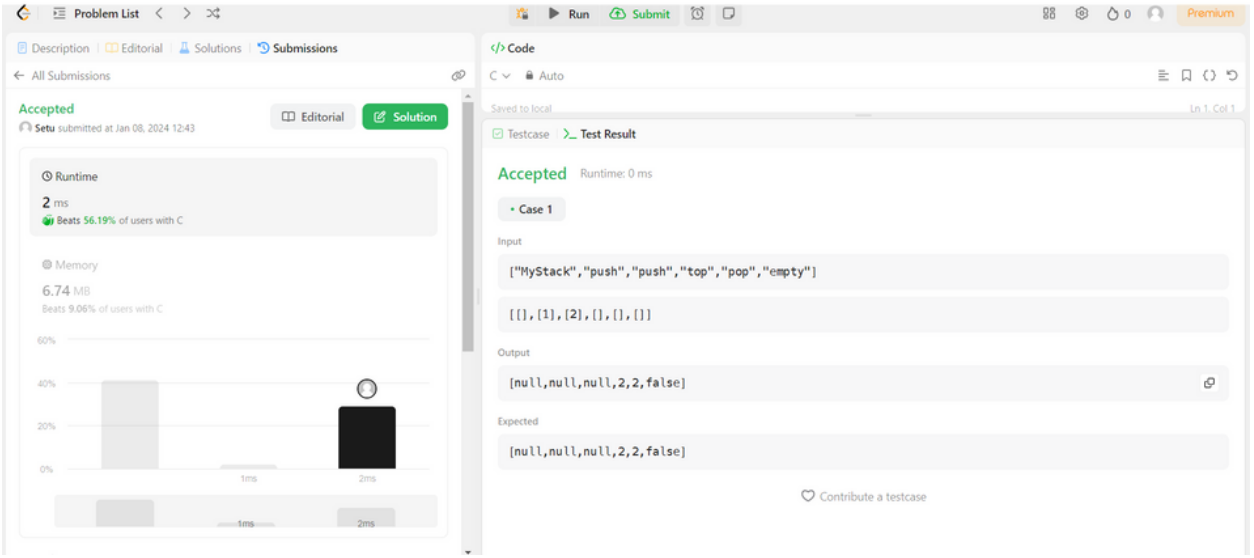


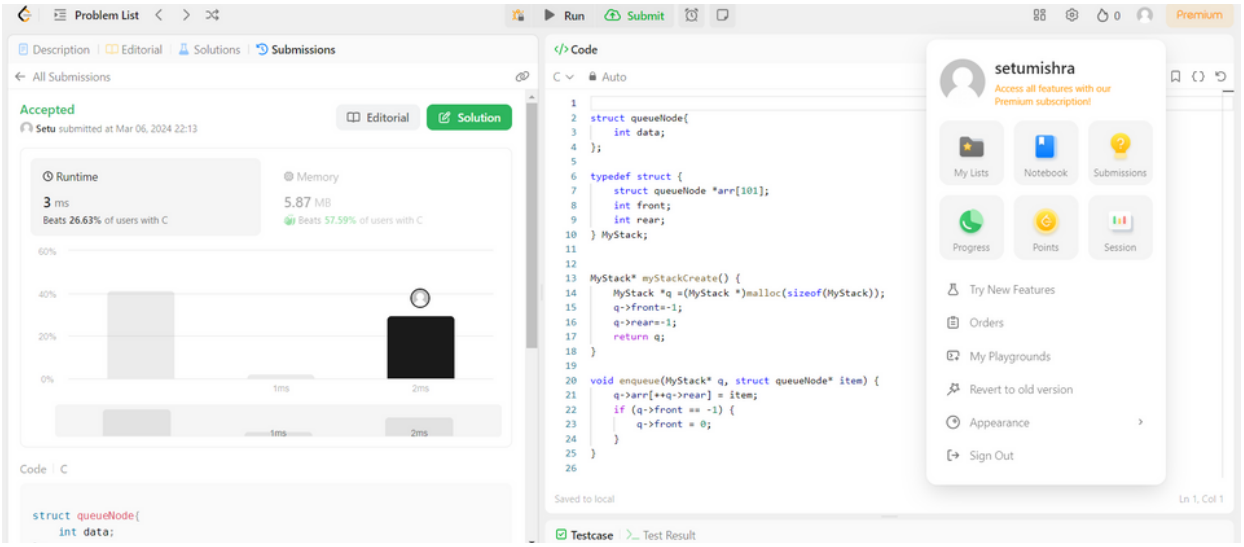

```c
void enqueue(MyStack* q, struct queueNode* item) {
    q->arr[++q->rear] = item;
    if (q->front == -1) {
        q->front = 0;
    }
}

struct queueNode* dequeue(MyStack* q) {

    struct queueNode* item = q->arr[q->front];
    if (q->front == q->rear) {
        q->front = q->rear = -1;
    } else {
        q->front++;
    }
    return item;
}

void myStackPush(MyStack* q, int x) {

  struct queueNode* node = (struct queueNode*) malloc(sizeof(struct queueNode));
    node->data = x;
    enqueue(q, node);
    int size = q->rear - q->front + 1;
    while (size > 1) {
        struct queueNode* front = dequeue(q);
```

C Auto

```c
    while (size > 1) {
        struct queueNode* front = dequeue(q);
        enqueue(q, front);
        size--;
    }
}

int myStackPop(MyStack* q) {

    struct queueNode* front = dequeue(q);
    int item = front->data;
    free(front);
    return item;
}

int myStackTop(MyStack* q) {

    struct queueNode* front = q->arr[q->front];
    return front->data;
}

bool myStackEmpty(MyStack* q) {
  return q->front == -1;
}

void myStackFree(MyStack* q) {
    while (!myStackEmpty(q)) {
```

```c
bool myStackEmpty(MyStack* q) {
  return q->front == -1;
}

void myStackFree(MyStack* q) {
    while (!myStackEmpty(q)) {
        struct queueNode* front = dequeue(q);
        free(front);
    }
    free(q);
}
```





Program 5:

5)a)5a) 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.

Display the contents of the linked list.

```
//deletion in LL
#include <stdio.h>
#include<stdlib.h>



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


void InsertAtBeginning( Node **head_ref,int
new_data); void DeleteAtBeginning( Node **head_ref);
void DeleteAtEnd( Node **head_ref);
void Delete( Node **prev_node,int pos);
void PrintList(Node * next);
```

```
void InsertAtBeginning( Node **head_ref,int new_data)
{
   Node *new_node=(struct Node*)malloc(sizeof( Node));
new_node->data=new_data;
new_node->next=*head_ref;
*head_ref=new_node;
}

void DeleteAtBeginning( Node **head_ref)
{
Node *ptr;
if(head_ref == NULL)
{
printf("\nList is empty");
}
else
{
ptr = *head_ref;
*head_ref = ptr->next;
free(ptr);
printf("\n Node deleted from the beginning ...");

}

}
```

```
void                DeleteAtEnd(Node
**head_ref) {
Node *ptr,*ptr1;

if(*head_ref == NULL)

{

printf("\nlist is empty");

}

else if((*head_ref)-> next == NULL)

{

free(*head_ref);

*head_ref= NULL;

printf("\nOnly node of the list deleted ...");

}
```

```
else

{

ptr = *head_ref;

while(ptr->next != NULL)

{

ptr1 = ptr;

ptr = ptr ->next;

}

ptr1->next = NULL;

free(ptr);

printf("\n Deleted Node from the last ...");

}
```

```
}
void Delete(Node **head_ref, int
pos) {
    Node *temp = *head_ref, *prev;

   if (temp == NULL)
   {
      printf("\nList is empty");
   return;
   }

   if (pos == 0)
   {
   *head_ref = temp->next;
   free(temp);
      printf("\nDeleted node with position %d", pos);
   return;
   }

   for (int i = 0; temp != NULL && i < pos - 1;
   i++) {
   prev = temp;
   temp = temp->next;
   }
```

```
   if (temp == NULL)
   {
      printf("\nPosition out of range");
   return;
   }

prev->next = temp->next;
free(temp);
   printf("\nDeleted node with position %d", pos);
}
void PrintList(Node *node)
{
while (node!=NULL)
{
printf("%d\n",node->data);
node=node->next;
}

}


int main()
{
int ch,new,pos;
   Node* head=NULL;
while(ch!=6)
```

```
{
printf("Menu\n");
printf("1.Create a linked list\n");
printf("2.Delete at beginning\n");
printf("3.Delete at a specific position\n");
printf("4..Delete at end\n");
printf("5..Display linked list\n");
printf("6..Exit\n");
printf("Enter your choice\n");
scanf("%d",&ch);
switch(ch)
{
case 1:
{
   printf("Enter the data you want to insert at beginning\n");
scanf("%d",&new);
InsertAtBeginning(&head,new);
break;
}
case 2:
{
DeleteAtBeginning(&head);
break;
}
case 3:
```

```
{
printf("Enter the position at which you want to delete
\n"); scanf("%d",&pos);
Delete(&head,pos);
break;
}
case 4:
{
DeleteAtEnd(&head);
break;
}
case 5:
{
printf("Created linked list is:\n");
PrintList(head);
break;
}
case 6:
{
return 0;
break;
}
default:
{
printf("Invalid data!");
```

```
        break;
}
}
}
return 0;
}
```

```
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
1
Enter the data you want to insert at beginning
22
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
1
Enter the data you want to insert at beginning
45
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
5
Created linked list is:
45
22
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
1
Enter the data you want to insert at beginning
56
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
4
```

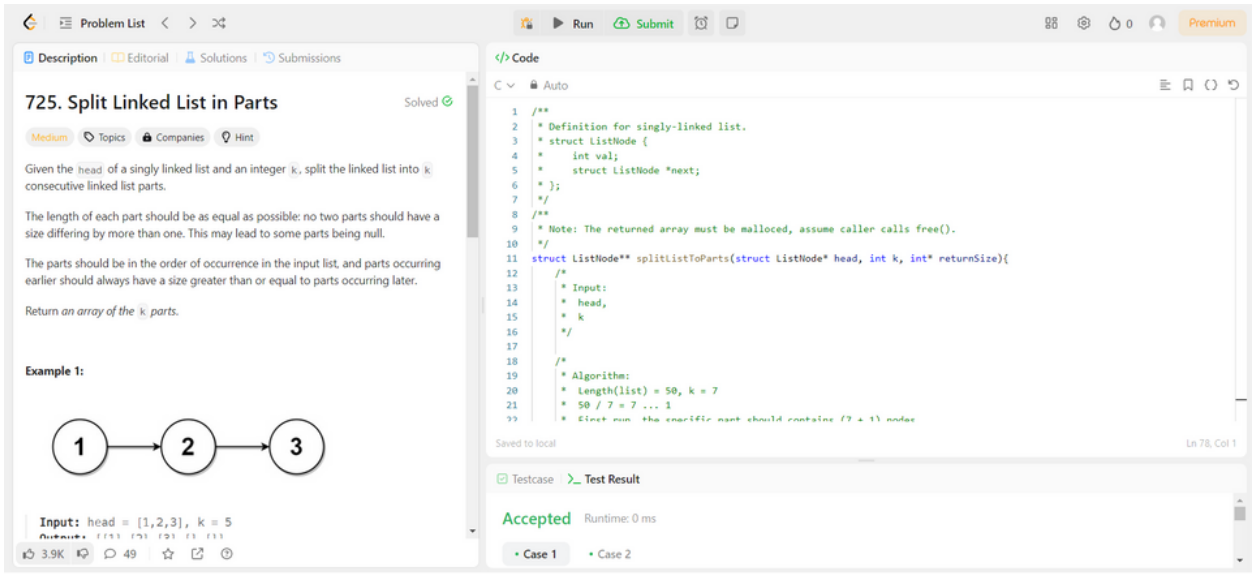
```
 Deleted Node from the last ...Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
5
Created linked list is:
56
45
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
2

 Node deleted from the beginning ...Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
5
Created linked list is:
45
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
6


...Program finished with exit code 0
Press ENTER to exit console.
```

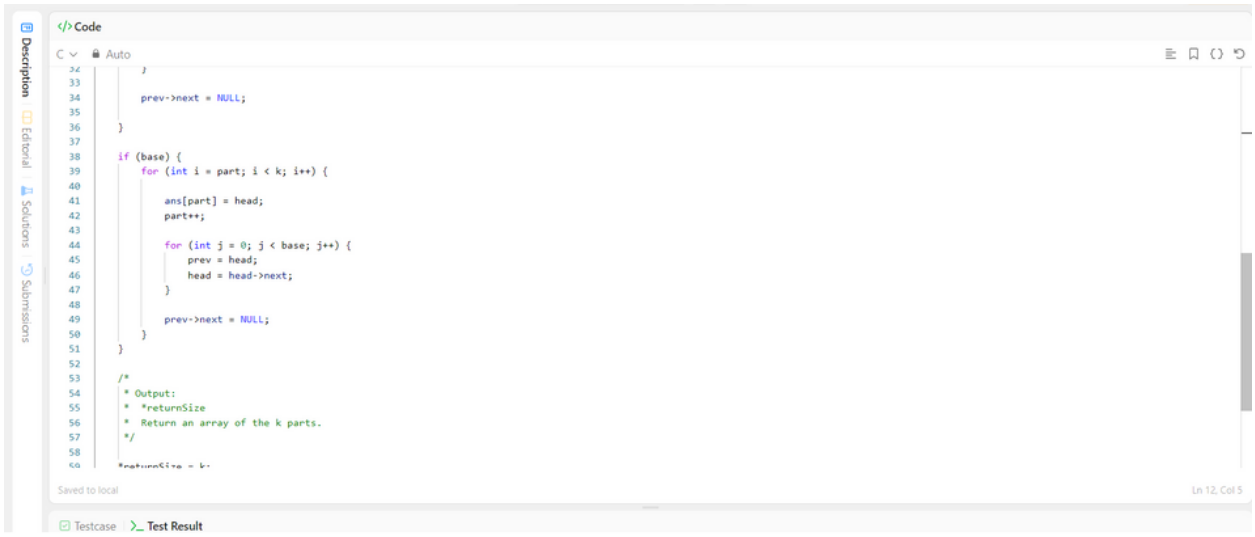
End of document

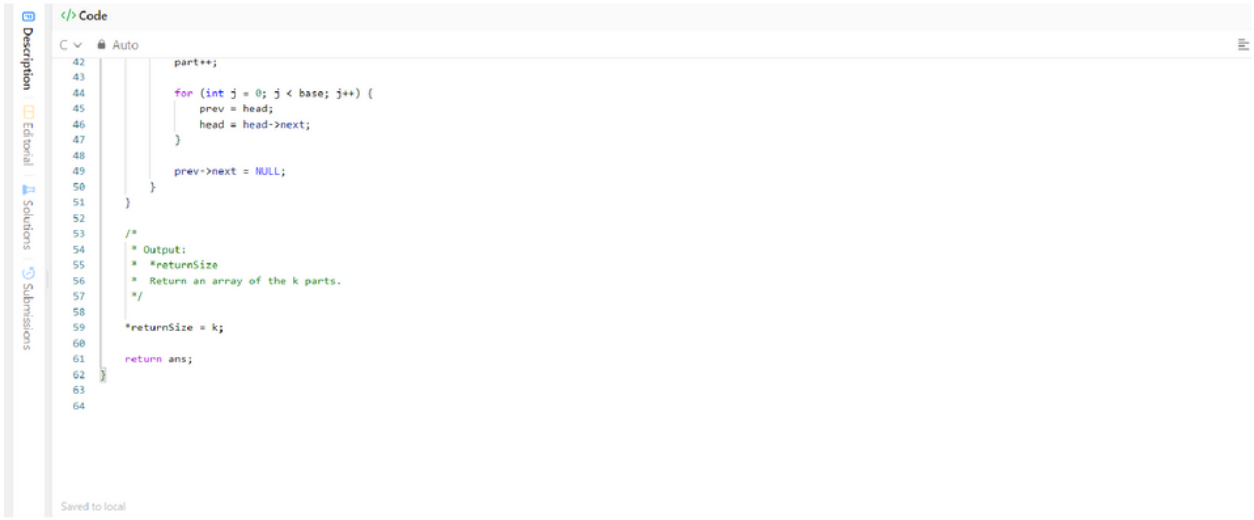
```
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
1
Enter the data you want to insert at beginning
12
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
1
Enter the data you want to insert at beginning
23
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
1
Enter the data you want to insert at beginning
34
Menu
1.Create a linked list
2.Delete at beginning
```

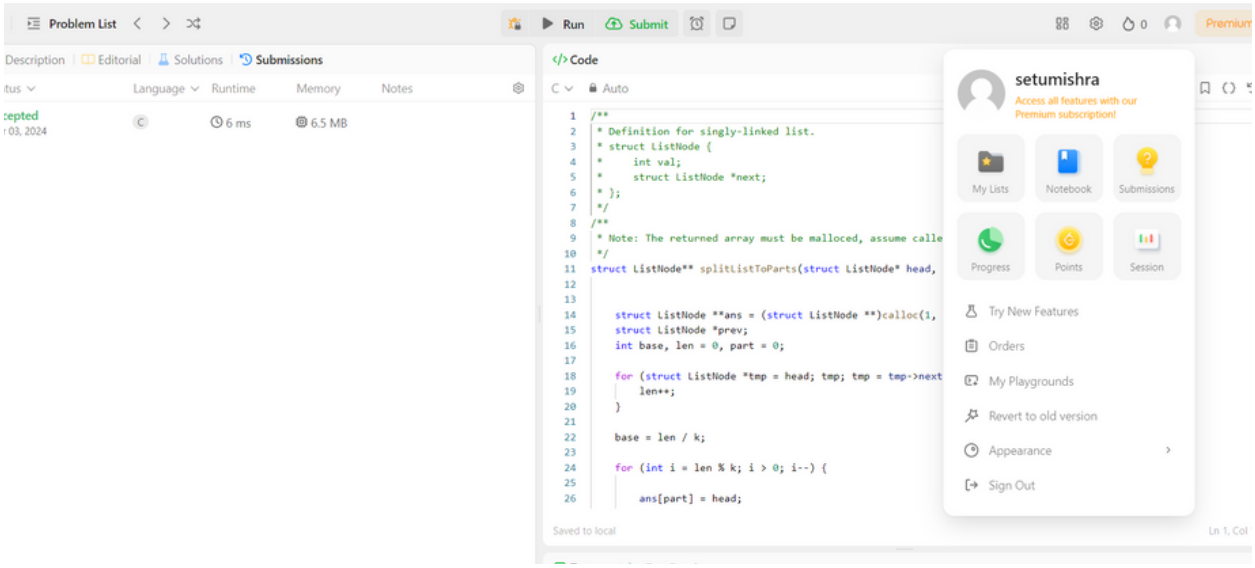
```
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
1
Enter the data you want to insert at beginning
34
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
5
Created linked list is:
34
23
12
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
5..Display linked list
6..Exit
Enter your choice
3
Enter the position at which you want to delete
1
```

5)b) Program - Leetcode platform




Description
Editorial
Solutions
Submissions
Code
Auto
prev->next = NULL;
}
if (base) {
for (int i = part; i < k; i++) {
ans[part] = head;
part++;
for (int j = 0; j < base; j++) {
prev = head;
head = head->next;
}
prev->next = NULL;
}
}
/*
* Output:
* *returnSize
* Return an array of the k parts.
*/
Saved to local
Ln 12, Col 5
Testcase
Test Result


Description
Editorial
Solutions
Submissions
Code
Auto
part++;
for (int j = 0; j < base; j++) {
prev = head;
head = head->next;
}
prev->next = NULL;
}
}
/*
* Output:
* *returnSize
* Return an array of the k parts.
*/
*returnSize = k;
return ans;
}
Saved to local


Problem List
Run
Submit
Premium
Description
Editorial
Solutions
Submissions
Language
Runtime
Memory
Notes
6 ms
6.5 MB
Code
Auto
/**
* Definition for singly-linked list.
* struct ListNode {
* int val;
* struct ListNode *next;
* };
*/
/**
* Note: The returned array must be malloced, assume calle
*/
struct ListNode** splitListToParts(struct ListNode* head,
struct ListNode **ans = (struct ListNode **)calloc(1,
struct ListNode *prev;
int base, len = 0, part = 0;
for (struct ListNode *tmp = head; tmp; tmp = tmp->next
len++;
}
base = len / k;
for (int i = len % k; i > 0; i--) {
ans[part] = head;
setumishra
Access all features with our Premium subscription!
My Lists
Notebook
Submissions
Progress
Points
Session
Try New Features
Orders
My Playgrounds
Revert to old version
Appearance
Sign Out
Saved to local

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;
};

// Function to create a new node
struct Node* createNode(int data) {
   struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
if (newNode == NULL) {
printf("Memory allocation failed\n");
exit(1);
}
newNode->data = data;
newNode->next = NULL;
return newNode;
}
```

```
// Function to insert a node at the end of the linked
list void insertEnd(struct Node **head, int data) {
struct Node *newNode = createNode(data);
if (*head == NULL) {
*head = newNode;
return;
}
struct Node *temp = *head;
while (temp->next != NULL) {
temp = temp->next;
}
temp->next = newNode;
}

// Function to display the linked
list void display(struct Node *head)
{
if (head == NULL) {
      printf("Linked list is empty\n");
return;
}
struct Node *temp = head;
```

```
while (temp != NULL) {
      printf("%d -> ", temp->data);
temp = temp->next;
}
printf("NULL\n");
}

// Function to sort the linked list in ascending
order void sortLinkedList(struct Node **head) {
if (*head == NULL || (*head)->next == NULL)
return;

  struct Node *current =
  *head; struct Node *index =
  NULL;
  int temp;
  while (current != NULL) {
  index = current->next;
  while (index != NULL) {
        if (current->data > index->data) {
  temp = current->data;
  current->data = index->data;
```

```
            index->data = temp;
    }
    index = index->next;
    }
        current = current->next;
    }
}

// Function to reverse the linked list
void reverseLinkedList(struct Node **head) {
struct Node *prev = NULL;
struct Node *current = *head;
struct Node *next = NULL;

    while (current != NULL) {
next = current->next;
         current->next = prev;
prev = current;
current = next;
}
*head = prev;
}
```

```
// Function to concatenate two linked lists
void concatenateLinkedLists(struct Node **head1, struct Node *head2)
{
if (*head1 == NULL) {
*head1 = head2;
return;
}
struct Node *temp = *head1;
while (temp->next != NULL) {
temp = temp->next;
}
temp->next = head2;
}

int main() {
   struct Node *list1 = NULL;
   struct Node *list2 = NULL;
int n, data;

   printf("Enter the number of elements for the first linked list:
   "); scanf("%d", &n);
   printf("Enter the elements for the first linked list:\n");
```

```
for (int i = 0; i < n; i++) {
    scanf("%d", &data);
   insertEnd(&list1, data);
}

printf("Enter the number of elements for the second linked list:
"); scanf("%d", &n);
printf("Enter the elements for the second linked list:\n");
for (int i = 0; i < n; i++) {
scanf("%d", &data);
insertEnd(&list2, data);
}

printf("First linked list: ");
display(list1);
printf("Second linked list:
"); display(list2);

// Sorting first linked list
sortLinkedList(&list1);
printf("First linked list after sorting:
"); display(list1);
```

```
    // Reversing second linked list
    reverseLinkedList(&list2);
    printf("Second linked list after reversing:
    "); display(list2);

    // Concatenating two linked lists
    concatenateLinkedLists(&list1, list2);
    printf("Concatenated linked list: ");
    display(list1);

    return 0;
}
```

```
Enter the number of elements for the first linked list: 4
Enter the elements for the first linked list:
1
2
3
4
Enter the number of elements for the second linked list: 4
Enter the elements for the second linked list:
5
6
7
8
First linked list: 1 -> 2 -> 3 -> 4 -> NULL
Second linked list: 5 -> 6 -> 7 -> 8 -> NULL
First linked list after sorting: 1 -> 2 -> 3 -> 4 -> NULL
Second linked list after reversing: 8 -> 7 -> 6 -> 5 -> NULL
Concatenated linked list: 1 -> 2 -> 3 -> 4 -> 8 -> 7 -> 6 -> 5 -> NULL


...Program finished with exit code 0
Press ENTER to exit console.
```

```
Enter the number of elements for the first linked list: 3
Enter the elements for the first linked list:
44
55
66
Enter the number of elements for the second linked list: 3
Enter the elements for the second linked list:
77
88
99
First linked list: 44 -> 55 -> 66 -> NULL
Second linked list: 77 -> 88 -> 99 -> NULL
First linked list after sorting: 44 -> 55 -> 66 -> NULL
Second linked list after reversing: 99 -> 88 -> 77 -> NULL
Concatenated linked list: 44 -> 55 -> 66 -> 99 -> 88 -> 77 -> NULL


...Program finished with exit code 0
Press ENTER to exit console.
```

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

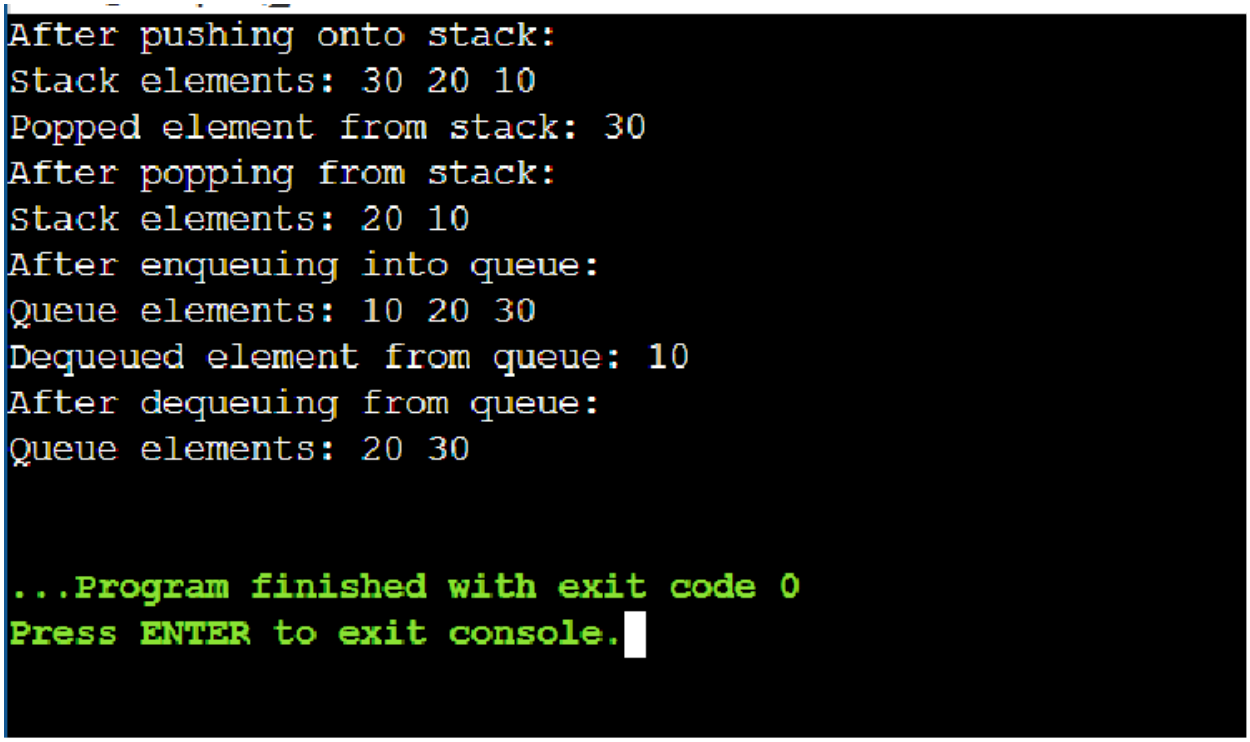
```
#include  <stdio.h>
#include
<stdlib.h>
struct Node {
int data;
   struct Node *next;
};

struct Node* createNode(int data) {
   struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
if (newNode == NULL) {
printf("Memory allocation failed\n");
exit(1);
}
newNode->data = data;
newNode->next = NULL;
return newNode;
}

void push(struct Node **top, int data) {
   struct Node *newNode = createNode(data);
newNode->next = *top;
*top = newNode;
```

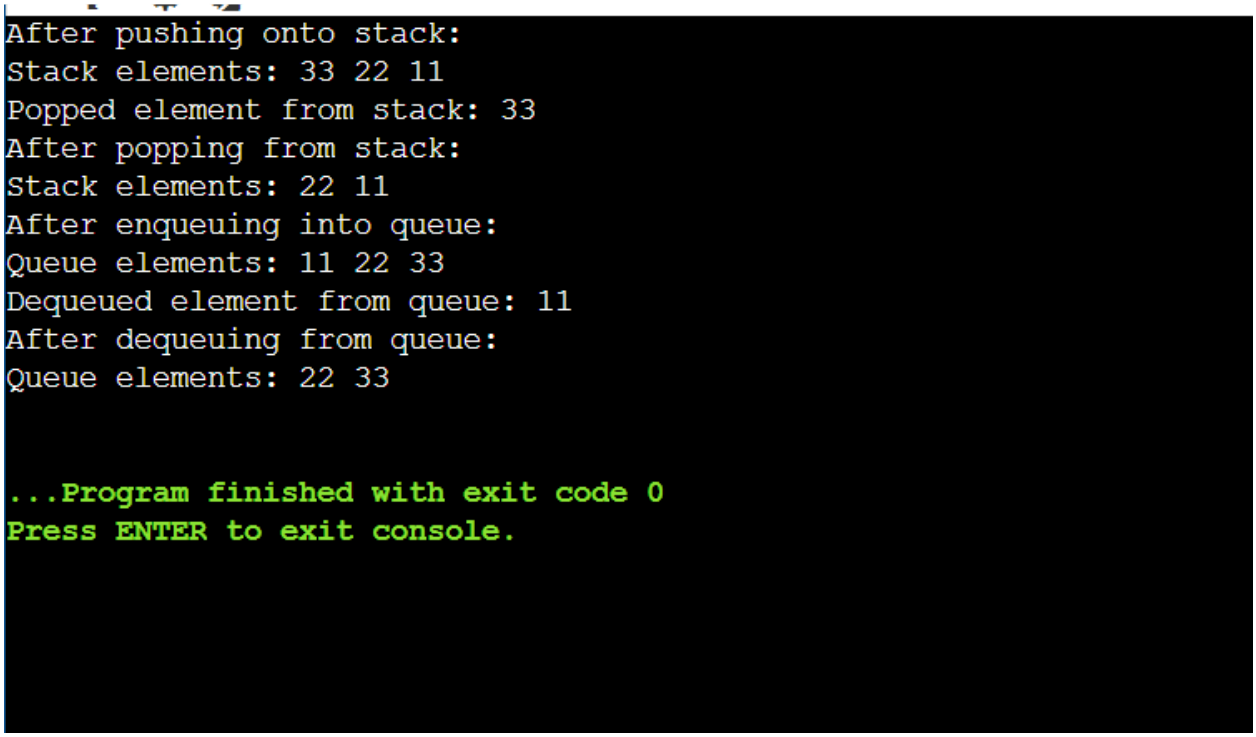
```
}

int pop(struct Node **top) {
if (*top == NULL) {
      printf("Stack Underflow\n");
exit(1);
}
struct Node *temp = *top;
int data = temp->data;
*top = (*top)->next;
free(temp);
return data;
}

void enqueue(struct Node **front, struct Node **rear, int data) {
struct Node *newNode = createNode(data);
if (*rear == NULL) {
*front = *rear = newNode;
} else {
(*rear)->next = newNode;
*rear = newNode;
}
}

int dequeue(struct Node **front, struct Node **rear) {
```

```
    if (*front == NULL) {
        printf("Queue Underflow\n");
    exit(1);
    }
    struct Node *temp = *front;
    int data = temp->data;
    if (*front == *rear) {
    *front = *rear = NULL;
    } else {
    *front = (*front)->next;
    }
    free(temp);
    return data;
}

void displayStack(struct Node *top) {
if (top == NULL) {
printf("Stack is empty\n");
return;
}
printf("Stack elements: ");
while (top != NULL) {
printf("%d ", top->data);
top = top->next;
    }
```

```
    printf("\n");
}

void displayQueue(struct Node *front) {
if (front == NULL) {
printf("Queue is empty\n");
return;
}
printf("Queue elements: ");
while (front != NULL) {
printf("%d ", front->data);
front = front->next;
}
printf("\n");
}

int main() {
    struct Node *stackTop = NULL;
   struct Node *queueFront = NULL;
     struct Node *queueRear = NULL;

   // Pushing elements onto the stack
   push(&stackTop,10);
   push(&stackTop,20);
   push(&stackTop,30);
```

```
    printf("After pushing onto
    stack:\n"); displayStack(stackTop);

    // Popping elements from the stack
    printf("Popped element from stack: %d\n",
    pop(&stackTop)); printf("After popping from stack:\n");
    displayStack(stackTop);

    // Enqueuing elements into the queue
    enqueue(&queueFront, &queueRear, 10);
    enqueue(&queueFront, &queueRear, 20);
    enqueue(&queueFront, &queueRear, 30);
    printf("After enqueuing into queue:\n");
    displayQueue(queueFront);

// Dequeuing elements from the queue
    printf("Dequeued element from queue: %d\n", dequeue(&queueFront,
&queueRear));
printf("After dequeuing from queue:\n");
displayQueue(queueFront);

    return 0;
}
```


After pushing onto stack:
Stack elements: 30 20 10
Popped element from stack: 30
After popping from stack:
Stack elements: 20 10
After enqueuing into queue:
Queue elements: 10 20 30
Dequeued element from queue: 10
After dequeuing from queue:
Queue elements: 20 30
...Program finished with exit code 0
Press ENTER to exit console.


After pushing onto stack:
Stack elements: 33 22 11
Popped element from stack: 33
After popping from stack:
Stack elements: 22 11
After enqueuing into queue:
Queue elements: 11 22 33
Dequeued element from queue: 11
After dequeuing from queue:
Queue elements: 22 33
...Program finished with exit code 0
Press ENTER to exit console.

Program 7:

7a) 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

Display the contents of the list

```
#include  <stdio.h>
#include
<stdlib.h>
struct Node {
int data;
   struct Node *prev;
   struct Node *next;
};

// Function to create a new node
struct Node* createNode(int data) {
   struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
if (newNode == NULL) {
printf("Memory allocation failed\n");
exit(1);
}
newNode->data = data;
newNode->prev = NULL;
```

```
    newNode->next           =
    NULL; return newNode;
}

// Function to insert a new node to the left of the given node
void insertLeft(struct Node **head, struct Node *givenNode, int data) {
struct Node *newNode = createNode(data);
if (*head == NULL) {
*head = newNode;
return;
}
if (givenNode == NULL) {
printf("Given node is NULL\n");
exit(1);
}
if (givenNode->prev != NULL) {
givenNode->prev->next = newNode;
newNode->prev = givenNode->prev;
}
givenNode->prev = newNode;
newNode->next = givenNode;
if (givenNode == *head) {
*head = newNode;
}

}
```

```
// Function to delete a node based on a specific
value void deleteNode(struct Node **head, int key) {
if (*head == NULL) {
printf("List is empty\n");
return;
}
struct Node *temp = *head;
while (temp != NULL && temp->data != key) {
temp = temp->next;
}
if (temp == NULL) {
      printf("Node with key %d not found\n", key);
return;
}
if (temp->prev != NULL) {
temp->prev->next = temp->next;
}
if (temp->next != NULL) {
temp->next->prev = temp->prev;
}
if (temp == *head) {
*head = temp->next;
}
free(temp);
```

```
}

// Function to display the contents of the
list void display(struct Node *head) {
if (head == NULL) {
printf("List is empty\n");
return;
}
printf("List contents: ");
while (head != NULL) {
printf("%d ", head->data);
head = head->next;
}
printf("\n");
}


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


   do{
   printf("\n1. Create a doubly linked list\n");
      printf("2. Insert a new node to the left of the given node\n");
   printf("3. Delete the node based on a specific value\n");
   printf("4. Display the contents of the list\n");
```

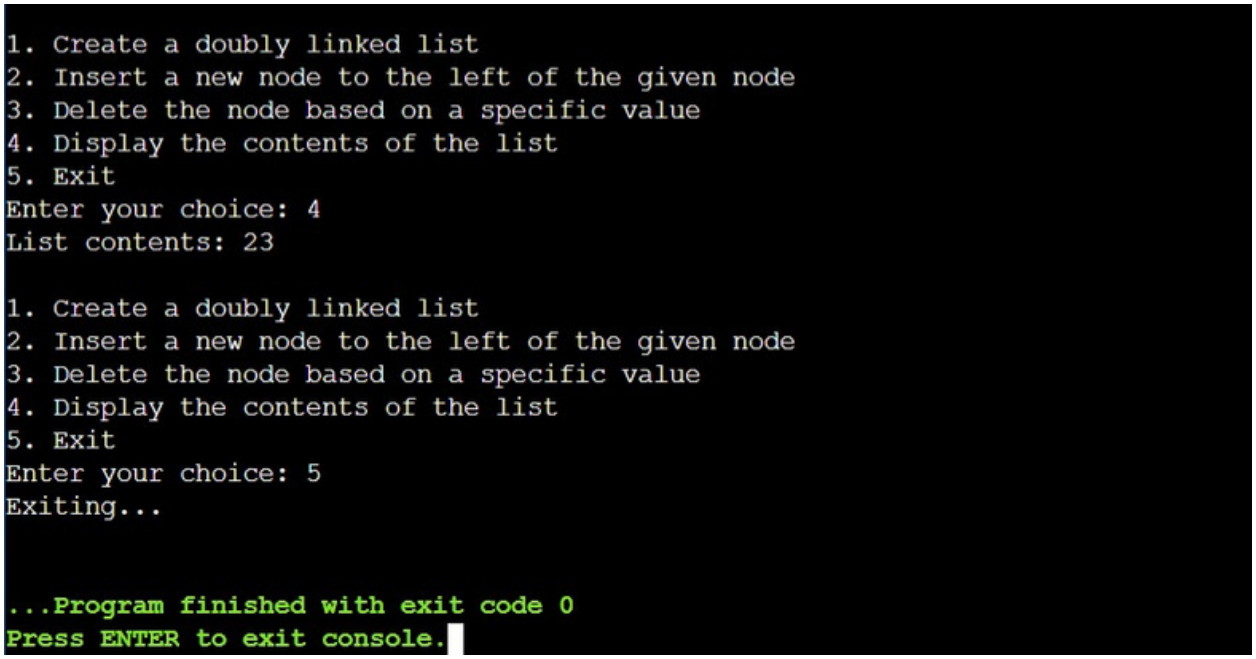
```
printf("5. Exit\n");
printf("Enter your choice: ");
scanf("%d", &choice);

switch (choice) {
case 1:
       printf("Enter the value for the first node: ");
scanf("%d", &value);
head = createNode(value);
break;
case 2:
     printf("Enter the value to be inserted: ");
scanf("%d", &value);
      printf("Enter the value of the given node: ");
scanf("%d", &key);
insertLeft(&head, head, value);
break;
case 3:
      printf("Enter the value to be deleted: ");
scanf("%d", &key);
deleteNode(&head, key);
break;
case 4:
display(head);
break;
```

```
    case 5:
    printf("Exiting...\n");
    break;
    default:
            printf("Invalid choice\n");
    }
    } while (choice != 5);

    return 0;
}
```

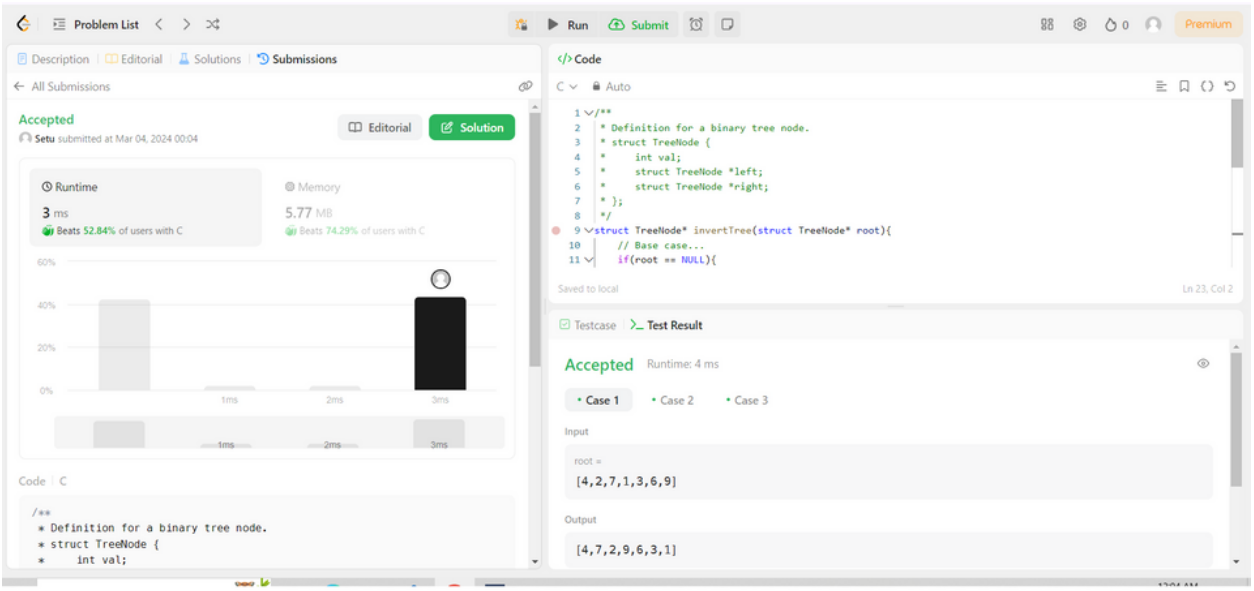
```
1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 1
Enter the value for the first node: 22

1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 2
Enter the value to be inserted: 34
Enter the value of the given node: 22

1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 4
List contents: 34 22

1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 2
Enter the value to be inserted: 56
Enter the value of the given node: 34
```

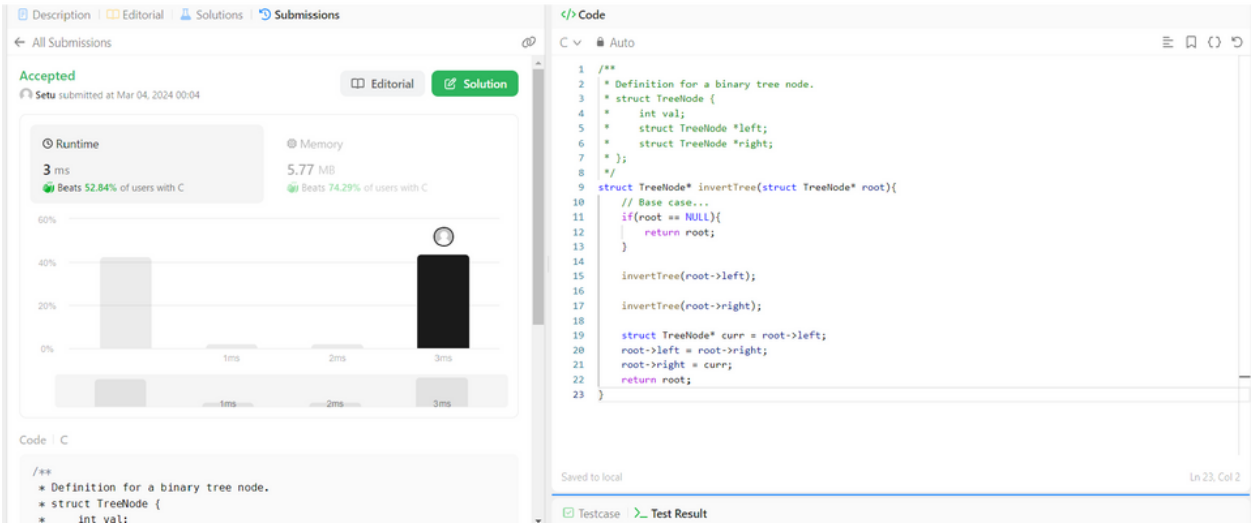
```
1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 4
List contents: 56 34 22

1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 5
Exiting...


...Program finished with exit code 0
Press ENTER to exit console.
```

```
1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 1
Enter the value for the first node: 23

1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 2
Enter the value to be inserted: 45
Enter the value of the given node: 23

1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 4
List contents: 45 23

1. Create a doubly linked list
2. Insert a new node to the left of the given node
3. Delete the node based on a specific value
4. Display the contents of the list
5. Exit
Enter your choice: 3
Enter the value to be deleted: 45
```



7b) Program - Leetcode platform


Problem List
Run
Submit
Premium
Description
Editorial
Solutions
Submissions
All Submissions
Accepted
Setu submitted at Mar 04, 2024 00:04
Editorial
Solution
Runtime
3 ms
Beats 52.84% of users with C
Memory
5.77 MB
Beats 74.29% of users with C
Code
C
Auto
/**
* Definition for a binary tree node.
* struct TreeNode {
* int val;
* struct TreeNode *left;
* struct TreeNode *right;
* };
*/
struct TreeNode* invertTree(struct TreeNode* root){
// Base case...
if(root == NULL){
Saved to local
Ln 23, Col 2
Testcase
Test Result
Accepted
Runtime: 4 ms
Case 1
Case 2
Case 3
Input
root =
[4,2,7,1,3,6,9]
Output
[4,7,2,9,6,3,1]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All Submissions
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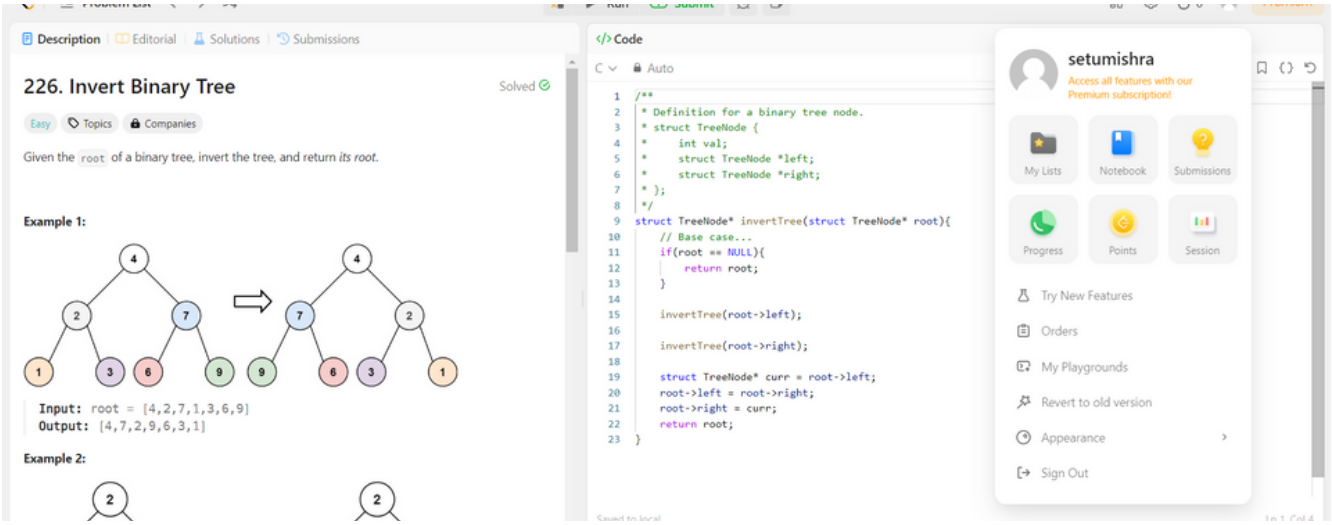
Code
C
Auto
/**
* Definition for a binary tree node.
* struct TreeNode {
* int val;
* struct TreeNode *left;
* struct TreeNode *right;
* };
*/
struct TreeNode* invertTree(struct TreeNode* root){
// Base case...
if(root == NULL){
return root;
}
invertTree(root->left);
invertTree(root->right);
struct TreeNode* curr = root->left;
root->left = root->right;
root->right = curr;
return root;
}
Saved to local
Ln 23, Col 2
Testcase
Test Result


Description
Editorial
Solutions
Submissions
226. Invert Binary Tree
Solved
Easy
Topics
Companies
Given the root of a binary tree, invert the tree, and return its root.
Example 1:
Input: root = [4,2,7,1,3,6,9]
Output: [4,7,2,9,6,3,1]
Example 2:
Code
C
Auto
/**
* Definition for a binary tree node.
* struct TreeNode {
* int val;
* struct TreeNode *left;
* struct TreeNode *right;
* };
*/
struct TreeNode* invertTree(struct TreeNode* root){
// Base case...
if(root == NULL){
return root;
}
invertTree(root->left);
invertTree(root->right);
struct TreeNode* curr = root->left;
root->left = root->right;
root->right = curr;
return root;
}
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Access all features with our Premium subscription!
My Lists
Notebook
Submissions
Progress
Points
Session
Try New Features
Orders
My Playgrounds
Revert to old version
Appearance
Sign Out

Program 8:

8a) Write a program

a) To construct a binary Search tree.

b)Totraversethetreeusingallthemethodsi.e.,in-order,

preorder and post order

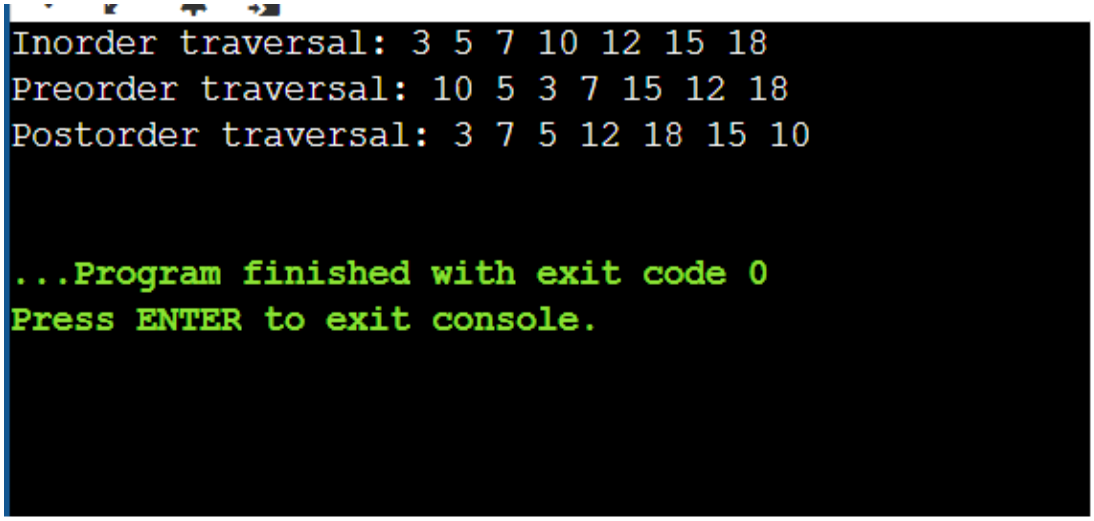
To display the elements in the tree.

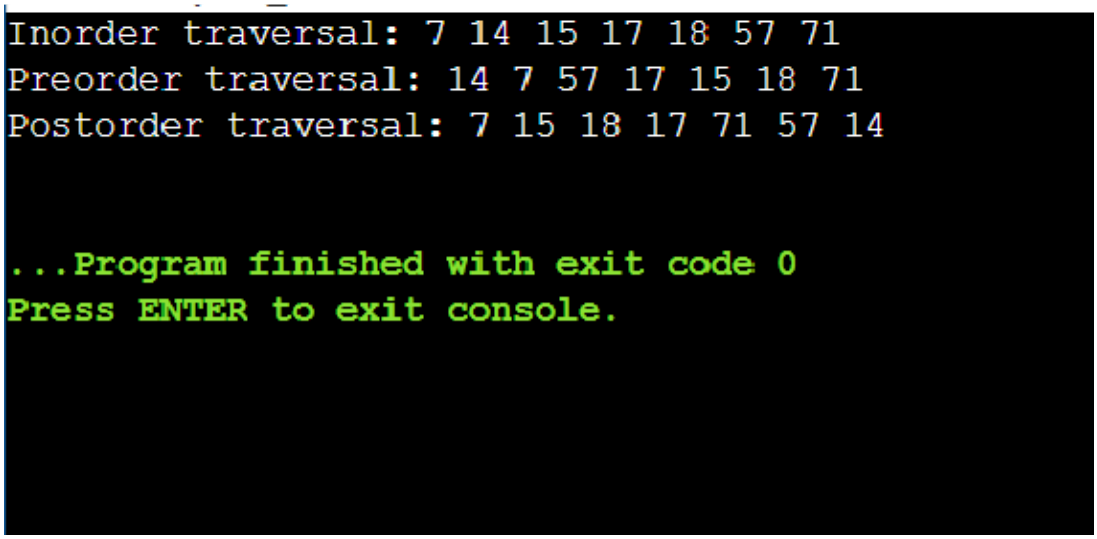
```
#include<stdio.h>
#include<stdlib.h>
struct TreeNode {
int data;
struct TreeNode* left;
struct TreeNode* right;
};
struct TreeNode* createNode(int data) {
  struct TreeNode* newNode = (struct TreeNode*)malloc(sizeof(struct
TreeNode));
newNode->data = data;
newNode->left = NULL;
newNode->right = NULL;
return newNode;
}
struct TreeNode* insertNode(struct TreeNode* root, int data) {
if (root == NULL) {
root = createNode(data);
```

```
    } else if (data <= root->data) {
        root->left = insertNode(root->left, data);
    } else {
       root->right = insertNode(root->right, data);
    }
    return root;
}

void inorderTraversal(struct TreeNode* root) {
if (root != NULL) {
inorderTraversal(root->left);
printf("%d ", root->data);
inorderTraversal(root->right);
    }
}

void preorderTraversal(struct TreeNode* root) {
if (root != NULL) {
printf("%d ", root->data);
preorderTraversal(root->left);
preorderTraversal(root->right);
}
}

void postorderTraversal(struct TreeNode* root) {
```

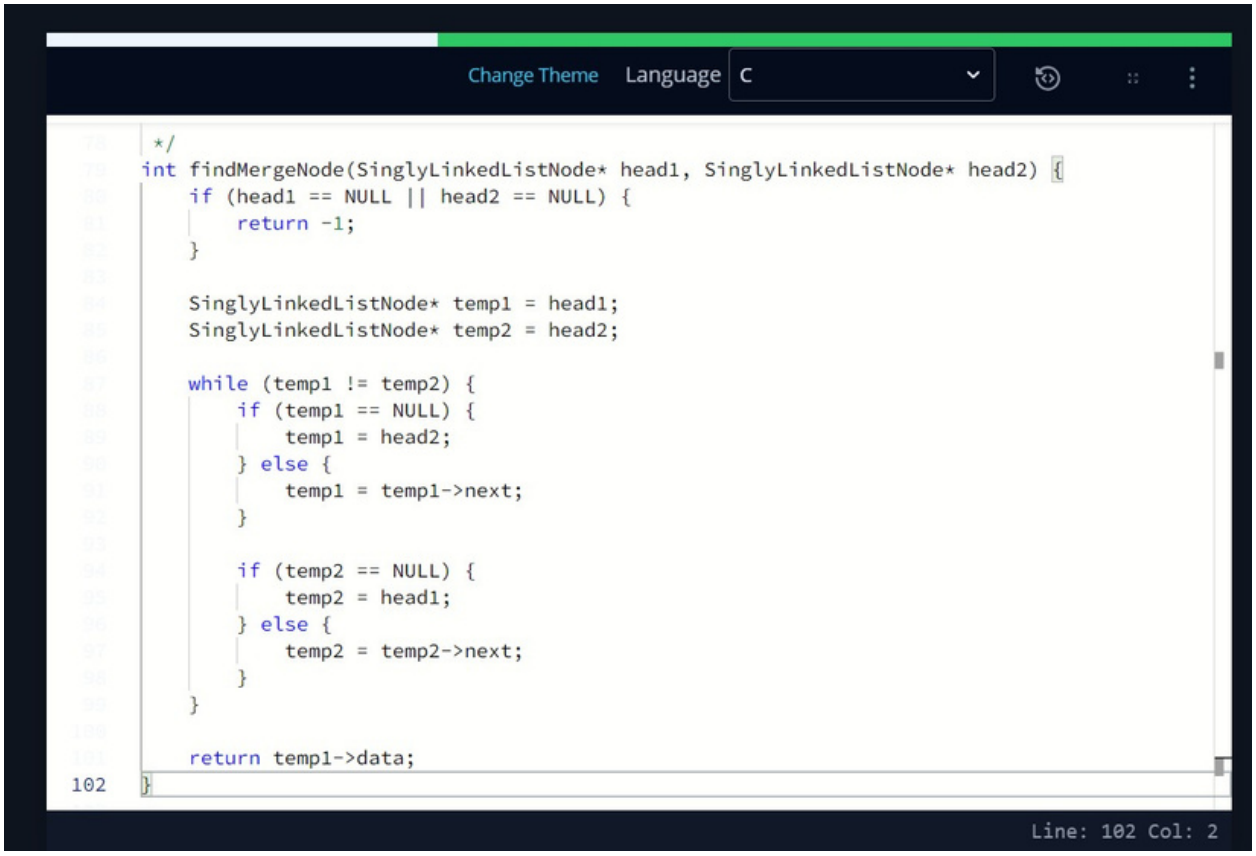
```
    if (root != NULL) {
      postorderTraversal(root->left);
       postorderTraversal(root->right);
    printf("%d ", root->data);
    }
}

void display(struct TreeNode* root) {
printf("Inorder traversal: ");
inorderTraversal(root);
printf("\n");

    printf("Preorder traversal: ");
    preorderTraversal(root);
    printf("\n");

   printf("Postorder traversal: ");
postorderTraversal(root);
printf("\n");
}

int main() {
   struct TreeNode* root = NULL;
    root = insertNode(root, 10);
root = insertNode(root, 5);
```

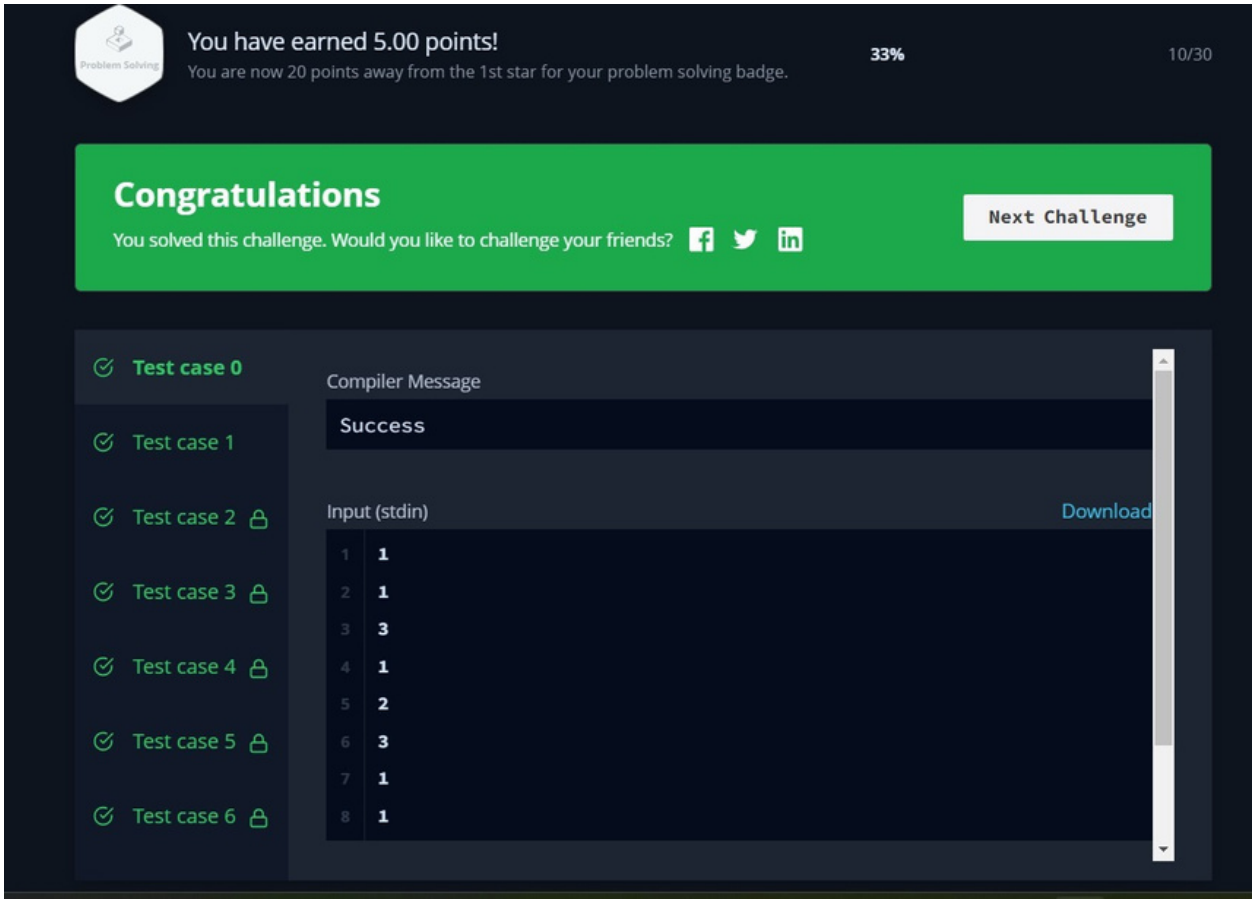
```
    root = insertNode(root, 15);
    root = insertNode(root, 3);
    root = insertNode(root, 7);
    root = insertNode(root, 12);
    root = insertNode(root, 18);
    display(root);

    return 0;
}
```





8)b) Program - Leetcode platform




You have earned 5.00 points!
You are now 20 points away from the 1st star for your problem solving badge.
33%
10/30
Congratulations
You solved this challenge. Would you like to challenge your friends?
Next Challenge
Test case 0
Test case 1
Test case 2
Test case 3
Test case 4
Test case 5
Test case 6
Compiler Message
Success
Input (stdin)
Download
1
1
3
1
2
3
1
1

Program 9:

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

```
#include  <stdio.h>
#include
<stdlib.h>
#define MAX_VERTICES 100

// Structure to represent a node in the
graph struct Node {
int data;
struct Node* next;
};

// Structure to represent the graph
struct Graph {
int numVertices;
   struct Node* adjLists[MAX_VERTICES];
int visited[MAX_VERTICES];
};

// Function to create a new graph
struct Graph* createGraph(int vertices) {
   struct Graph* graph = (struct Graph*)malloc(sizeof(struct Graph));
graph->numVertices = vertices;
```

```
    for (int i = 0; i < vertices; i++) {
        graph->adjLists[i] = NULL;
    graph->visited[i] = 0;
    }

    return graph;
}

// Function to add an edge to the graph
void addEdge(struct Graph* graph, int src, int dest) {
// Add edge from src to dest
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
newNode->data = dest;
newNode->next = graph->adjLists[src];
graph->adjLists[src] = newNode;

   // Since it's an undirected graph, add an edge from dest to src as well
newNode = (struct Node*)malloc(sizeof(struct Node));
newNode->data = src;
newNode->next = graph->adjLists[dest];
graph->adjLists[dest] = newNode;
}

// Function to perform BFS traversal
```

```
void BFS(struct Graph* graph, int startVertex) {
// Create a queue for BFS
int queue[MAX_VERTICES];
int front = -1, rear = -1;

   // Mark the current node as visited and enqueue
   it graph->visited[startVertex] = 1;
   queue[++rear] = startVertex;

   while (front != rear) {
      // Dequeue a vertex from queue and print it
   int currentVertex = queue[++front];
   printf("%d ", currentVertex);

      // Get all adjacent vertices of the dequeued vertex currentVertex
      // If an adjacent vertex has not been visited, then mark it visited and enqueue
it
      struct Node* temp = graph-
      >adjLists[currentVertex]; while (temp) {
      int adjVertex = temp->data;
      if (!graph->visited[adjVertex]) {
      graph->visited[adjVertex] = 1;
      queue[++rear] = adjVertex;
      }
      temp = temp->next;
```

```
        }
    }
}

int main() {
int numVertices, numEdges;
    printf("Enter the number of vertices and edges: ");
scanf("%d %d", &numVertices, &numEdges);

    struct Graph* graph = createGraph(numVertices);

    printf("Enter the edges (src
    dest):\n"); for (int i = 0; i < numEdges;
    i++) {
    int src, dest;
    scanf("%d %d", &src, &dest);
    addEdge(graph, src, dest);
    }
    int startVertex;
    printf("Enter the starting vertex for BFS:
    "); scanf("%d", &startVertex);

    printf("BFS traversal starting from vertex %d: ",
    startVertex); BFS(graph,startVertex);
    printf("\n");
```

```
    return 0;
}
```

```
Enter the number of vertices and edges: 4
3
Enter the edges (src dest):
3
4
5
6
7
8
Enter the starting vertex for BFS: 3
BFS traversal starting from vertex 3: 3 4


...Program finished with exit code 0
Press ENTER to exit console.
```

```
Enter the number of vertices and edges: 3
2
Enter the edges (src dest):
1
2
3
4
Enter the starting vertex for BFS: 2
BFS traversal starting from vertex 2: 2 1


...Program finished with exit code 0
Press ENTER to exit console.
```

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

```
#include  <stdio.h>
#include
<stdlib.h>
#define MAX_VERTICES 100

// Structure to represent a node in the
graph struct Node {
int data;
struct Node* next;
};

// Structure to represent the graph
struct Graph {
int numVertices;
   struct Node* adjLists[MAX_VERTICES];
int visited[MAX_VERTICES];
};

// Function to create a new graph
struct Graph* createGraph(int vertices) {
   struct Graph* graph = (struct Graph*)malloc(sizeof(struct Graph));
graph->numVertices = vertices;
```

```
    for (int i = 0; i < vertices; i++) {
        graph->adjLists[i] = NULL;
    graph->visited[i] = 0;
    }

    return graph;
}

// Function to add an edge to the graph
void addEdge(struct Graph* graph, int src, int dest) {
// Add edge from src to dest
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
newNode->data = dest;
newNode->next = graph->adjLists[src];
graph->adjLists[src] = newNode;

   // Since it's an undirected graph, add an edge from dest to src as well
newNode = (struct Node*)malloc(sizeof(struct Node));
newNode->data = src;
newNode->next = graph->adjLists[dest];
graph->adjLists[dest] = newNode;
}

// Function to perform DFS traversal
void DFS(struct Graph* graph, int vertex) {
```

```
    graph->visited[vertex] = 1;

    struct Node* temp = graph->adjLists[vertex]; while (temp != NULL) {
    int adjVertex = temp->data;
    if (!graph->visited[adjVertex]) {
    DFS(graph, adjVertex);
    }
    temp = temp->next;
    }
}

// Function to check if the graph is connected
int isConnected(struct Graph* graph) {
  // Perform DFS traversal starting from vertex 0
DFS(graph, 0);

    // Check if all vertices are visited after DFS traversal for (int i = 0; i < graph->numVertices; i++)
    {
    if (!graph->visited[i]) {
    return 0; // Graph is not connected
    }
    }
} return 1; // Graph is connected
```

```
int main() {
int numVertices, numEdges;
   printf("Enter the number of vertices and edges: ");
scanf("%d %d", &numVertices, &numEdges);

   struct Graph* graph = createGraph(numVertices);

   printf("Enter the edges (src
   dest):\n"); for (int i = 0; i < numEdges;
   i++) {
   int src, dest;
   scanf("%d %d", &src, &dest);
   addEdge(graph, src, dest);
   }
   if (isConnected(graph)) {
   printf("The graph is connected.\n");
   } else {
      printf("The graph is not connected.\n");
   }

   return 0;
}
```

```
Enter the number of vertices and edges: 3
2
Enter the edges (src dest):
1
2
3
4
The graph is not connected.


...Program finished with exit code 0
Press ENTER to exit console.
```

```
Enter the number of vertices and edges: 4
3
Enter the edges (src dest):
4
5
6
7
8
9
The graph is not connected.


...Program finished with exit code 0
Press ENTER to exit console.
```

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>

#define M 100 // number of memory locations (m)

#define  N  1000  //  number  of  employee  records

(N) #define K 10000 // number of keys (K)


typedef struct {

int id;

   char name[50];
```

```
   float salary;
} Employee;

typedef struct Node {
int key;
Employee emp;
    struct Node *next;
} Node;

Node *HT[M]; // Hash Table (HT) of m memory locations

// Hash function to map key K to address space
L int hash(int key) {
return key % M;
}

// Function to insert employee record into Hash
Table void insert(Employee emp) {
int key = emp.id;
int index = hash(key);
   Node *newNode = (Node *)malloc(sizeof(Node));
newNode->key = key;
newNode->emp = emp;
newNode->next = NULL;
```

```
    if (HT[index] == NULL) {
    HT[index] = newNode;
    } else {
    Node *temp = HT[index];
    while (temp->next != NULL) {
    if (temp->key == key) {
            printf("Collision detected! Updating employee record...\n");
    temp->emp = emp;
    free(newNode);
    return;
    }
    temp = temp->next;
    }
    if (temp->key == key) {
    printf("Collision detected! Updating employee record...\n");
    temp->emp = emp;
    free(newNode);
    return;
    }
    temp->next = newNode;
    }
}

// Function to search employee record using key
K void search(int key) {
```

```
int index = hash(key);
Node *temp = HT[index];
while (temp != NULL) {
if (temp->key == key) {
          printf("Employee Record Found:\n");
printf("ID: %d\n", temp->emp.id);
printf("Name: %s\n", temp->emp.name);
           printf("Salary: %.2f\n", temp->emp.salary);
return;
}
temp = temp->next;
}
printf("Employee Record Not Found!\n");
}

int main() {
    // Insert employee records into Hash Table
for (int i = 0; i < N; i++) {
Employee emp;
emp.id = i + 1;
       sprintf(emp.name, "Employee %d", i + 1);
emp.salary = (float)(i + 1) * 1000;
insert(emp);
   }
```

```
    // Search employee record using key
    K int key = 500;
    search(key);

    return 0;
}
```