VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
On

DATA STRUCTURES (23CS3PCDST)

Submitted by

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in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
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B.M.S. COLLEGE OF ENGINEERING
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This is to certify that the Lab work entitled **"DATA STRUCTURES"** carried out by NAVEEN RAMKUMAR(1BM22CS173), who is a 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 year 2023-24. 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>

#define SIZE 30

int stack[SIZE];

int top=-1;

void push()

{

   if(top==SIZE-1)

      printf("Stack overflow.");

   else

   {

      top=top+1;

      printf("Enter the element that you would like to insert into the stack ");

      scanf("%d",&stack[top]);

      printf("The element inserted successfully.");

   }

}

void pop()

{

   if(top==-1)

      printf("Stack underflow.");

   else

   {
```

```
        printf("The element %d is popped.",stack[top]);
        top=top-1;
    }
}
void display()
{
    int run;
    if(top==-1)
        printf("Stack underflow.");
    else
    {
        printf("-----\n");
        for(run=top;run>=0;run--)
            printf("%d\n",stack[run]);
        printf("-----");
    }
}
void main()
{
    while(1)
    {
        int ch;
        printf("Enter 1 to push, 2 to pop, 3 to display the elements and 4 to exit ");
        scanf("%d",&ch);
        printf("\n");
        if(ch==1)
            push();
```

```
        else if(ch==2)
            pop();
        else if(ch==3)
            display();
        else if(ch==4)
            break;
        else
            printf("Invalid input.");
        printf("\n\n");
    }
}
```

Output:

```
The element inserted successfully.

Enter 1 to push, 2 to pop, 3 to display the elements and 4 to exit 1

Enter the element that you would like to insert into the stack 45
The element inserted successfully.

Enter 1 to push, 2 to pop, 3 to display the elements and 4 to exit 3

-----
45
23
-----

Enter 1 to push, 2 to pop, 3 to display the elements and 4 to exit 2

The element 45 is popped.

Enter 1 to push, 2 to pop, 3 to display the elements and 4 to exit 3

-----
23
-----

Enter 1 to push, 2 to pop, 3 to display the elements and 4 to exit 4


Process returned 4 (0x4)   execution time : 66.879 s
Press any key to continue.
```

Lab program 2:

Write a program 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), / (divide) and ^ (power).

```
#include <stdio.h>
#include <string.h>
#define SIZE 30
char infix[SIZE];
char postfix[SIZE];
char stack[15];
int top=-1;
int toppostfix=-1;
int isbracket=0;
void push(char c)
{
   if(top==SIZE-1)
      printf("Stack overflow.");
   else
   {
      top=top+1;
      stack[top]=c;
   }
}
char pop()
{
   if(top==-1)
      printf("Stack underflow.");
```

```
    else
    {
        top=top-1;
        return(stack[top+1]);
    }
}
int precedence(char c)
{
    if(c=='^')
        return(5);
    else if(c=='/')
        return(4);
    else if(c=='*')
        return(3);
    else if(c=='+')
        return(2);
    else if(c=='-')
        return(1);
}
void main()
{
    int i;
    printf("Enter the infix expression. ");
    scanf("%s",infix);
    for(i=0;i<strlen(infix);i++)
    {
        if((infix[i]>=65 && infix[i]<=90))
```

```
{
   toppostfix=toppostfix+1;
   postfix[toppostfix]=infix[i];
}
else if(infix[i]=='(')
{
   isbracket=1;
   push(infix[i]);
}
else if(top!=-1)
{
   if(precedence(infix[i])<precedence(stack[top]) || infix[i]==')')
   {
      while((isbracket==0 && top!=-1) || (isbracket==1 && stack[top]!='('))
      {
         toppostfix=toppostfix+1;
         postfix[toppostfix]=pop();
      }
      if(infix[i]==')')
      {
         pop();
         isbracket=0;
      }
      else
         push(infix[i]);
   }
   else
```

```
            {
                push(infix[i]);
            }
        }
        else
            push(infix[i]);
    }
    while(top!=-1)
    {
        toppostfix=toppostfix+1;
        postfix[toppostfix]=pop();
    }
    postfix[toppostfix+1]='\0';
    printf("\n\nThe postfix expression is %s",postfix);
}
```

Output:

```
Enter the infix expression. A*B+C*D-E


The postfix expression is AB*CD*+E-
Process returned 37 (0x25)   execution time : 29.555 s
Press any key to continue.
```

Lab program 3(a):

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 30
int queue[MAX];
int front=-1;
int rear=-1;
void insert(int element)
{
   if(rear==MAX-1)
      printf("Queue overflow");
   else
   {
      rear=rear+1;
      if(front==-1)
         front=front+1;
      queue[rear]=element;
   }
}
void delete()
{
   if(front>rear || (front==-1 && rear==-1))
      printf("Queue underflow");
   else
   {
```

```
        printf("The element popped is %d",queue[front]);
        front=front+1;
    }
}
void display()
{
    int i;
    if(front>rear || (front==-1 && rear==-1))
        printf("Queue underflow");
    else
    {
        for(i=front;i<=rear;i++)
            printf("%d ",queue[i]);
    }
}
void main()
{
    while(1)
    {
        int ch,element;
        printf("Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit ");
        scanf("%d",&ch);
        if(ch==1)
        {
            printf("Enter the element to insert into the queue ");
            scanf("%d",&element);
```

```
            insert(element);
        }
        else if(ch==2)
            delete();
        else if(ch==3)
            display();
        else if(ch==4)
            break;
        else
            printf("Invalid input");
        printf("\n\n");
    }

}
```

Output:

```
Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 1


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 2


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 3


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 3
1 2 3

Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 2
The element popped is 1

Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 3
2 3

Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 4

Process returned 4 (0x4)   execution time : 82.458 s
Press any key to continue.
```

Lab program 3b)

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 SIZE 5

int queue[SIZE];

int front=-1;

int rear=-1;

void insert(int element)

{

   if((rear+1)%SIZE==front)

      printf("Queue overflow");

   else

   {

      rear=(rear+1)%SIZE;

      if(front==-1)

         front=front+1;

      queue[rear]=element;

   }

}

void delete()

{

   if(front==-1 && rear==-1)

      printf("Queue underflow");

   else

   {

      printf("The element popped is %d",queue[front]);
```

```
        if(front==rear)
            front=rear=-1;
        else
            front=(front+1)%SIZE;
    }
}
void display()
{
    int i;
    if(front==-1 && rear==-1)
        printf("Queue underflow");
    else
    {
        i=front;
        while(1)
        {
            printf("%d ",queue[i]);
            if(i==rear)
                break;
            i=(i+1)%SIZE;
        }
    }
}
void main()
{
    while(1)
    {
```

```
    int ch,element;
    printf("Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit ");
    scanf("%d",&ch);
    if(ch==1)
    {
       printf("Enter the element to insert into the queue ");
       scanf("%d",&element);
       insert(element);
    }
    else if(ch==2)
       delete();
    else if(ch==3)
       display();
    else if(ch==4)
       break;
    else
       printf("Invalid input");
    printf("\n\n");
  }
}
```

Output:

```
Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 0


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 1


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 2


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 3


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 4


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 3
0 1 2 3 4

Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 2
The element popped is 0

Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 2
The element popped is 1

Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 3
2 3 4

Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 100


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 1
Enter the element to insert into the queue 200


Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 3
2 3 4 100 200

Enter 1 to insert elements into the queue, 2 to delete from the queue, 3 to display and 4 to exit 4
```

Lab program 4(a)

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 push()
{
   struct Node *new_node=malloc(sizeof(struct Node));
   int data;
   printf("Enter the data to be entered ");
   scanf("%d",&data);
   (*new_node).data=data;
   (*new_node).next=head;
   head=new_node;

}
void append()
{
   struct Node *new_node=malloc(sizeof(struct Node));
```

```
    int data;
    struct Node *last=head;
    printf("Enter the data to be entered ");
    scanf("%d",&data);
    (*new_node).data=data;
    (*new_node).next=NULL;
    if(head==NULL)
       head=new_node;
    else
    {
       while((*last).next!=NULL)
       {
          last=(*last).next;
       }

       (*last).next=new_node;
    }
}
void insert_at_pos(int pos)
{
    struct Node *new_node=malloc(sizeof(struct Node));
    struct Node *temp=head;
    int data;
    printf("Enter the data to be entered ");
    scanf("%d",&data);
    (*new_node).data=data;
    if(pos==1)
```

```
    {
        (*new_node).next=head;
        head=new_node;
        return;
    }
    int position=1;
    while(1)
    {
        if(position==pos-1)
            break;
        else
        {
            temp=(*temp).next;
            position=position+1;
        }
    }
    (*new_node).next=(*temp).next;
    (*temp).next=new_node;
}
void display()
{
    struct Node *node=head;
    while(1)
    {
        printf("%d ",(*node).data);
        if((*node).next==NULL)
            break;
```

```
        node=(*node).next;
    }
}
void main()
{
    int choice;
    while(1)
    {
        printf("Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to display the contents and 5 to exit. ");
        scanf("%d",&choice);
        if(choice==1)
            push();
        else if(choice==2)
            append();
        else if(choice==3)
        {
            int position;
            printf("Enter the position to insert the node. ");
            scanf("%d",&position);
            insert_at_pos(position);
        }
        else if(choice==4)
            display();
        else if(choice==5)
            break;
        else
```

```
            printf("Invalid input entered.");
        printf("\n\n");
    }
}
```

Output:

```
Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to display the contents and 5 to exit. 1
Enter the data to be entered 23


Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to display the contents and 5 to exit. 1
Enter the data to be entered 45


Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to display the contents and 5 to exit. 2
Enter the data to be entered 77


Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to display the contents and 5 to exit. 4
45 23 77

Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to display the contents and 5 to exit. 3
Enter the position to insert the node. 3
Enter the data to be entered 100


Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to display the contents and 5 to exit. 4
45 23 100 77

Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to display the contents and 5 to exit. 5

Process returned 5 (0x5)   execution time : 114.974 s
Press any key to continue.
```

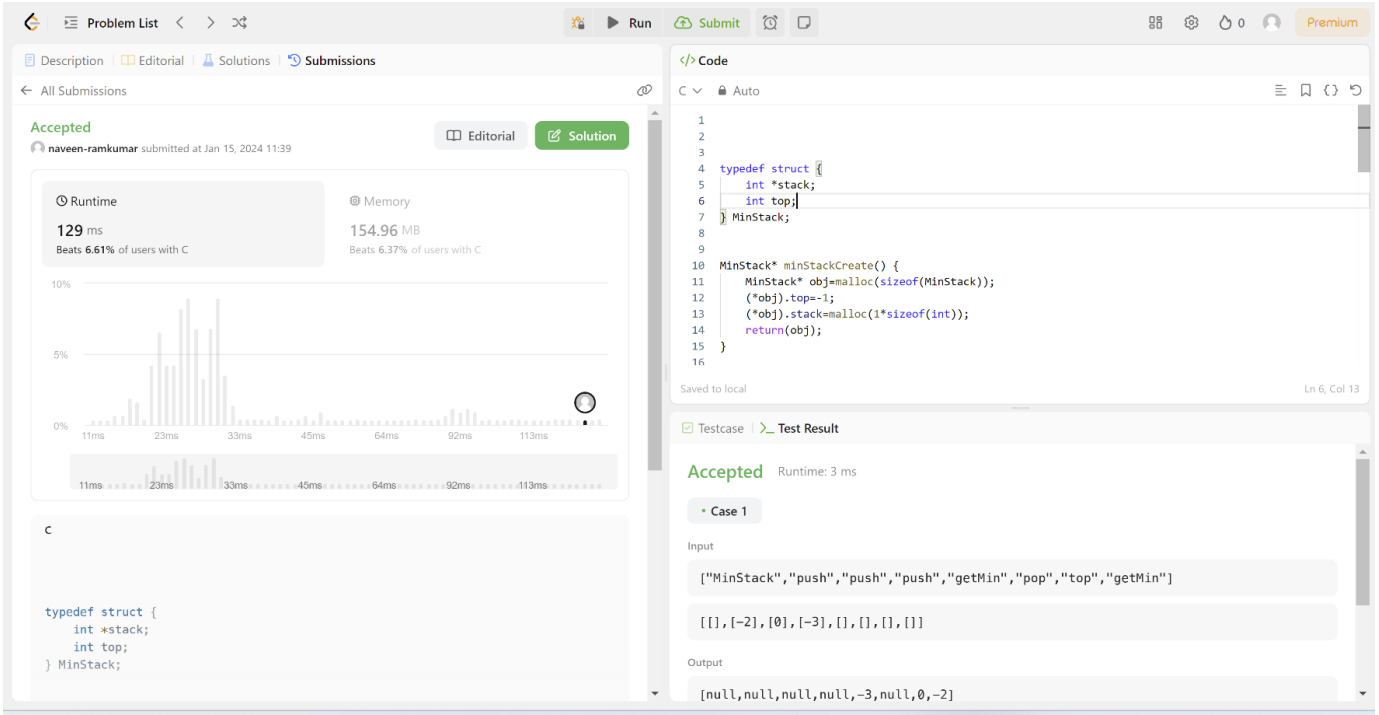
Lab program 4(b)

Demonstration of account creation on LeetCode platform and stack program

```
typedef struct {
    int *stack;
    int top;
} MinStack;


MinStack* minStackCreate() {
    MinStack* obj=malloc(sizeof(MinStack));
    (*obj).top=-1;
    (*obj).stack=malloc(1*sizeof(int));
    return(obj);
}

void minStackPush(MinStack* obj, int val) {
    (*obj).stack=realloc((*obj).stack,(++(*obj).top+1)*sizeof(int));
    *((*obj).stack+(*obj).top)=val;
```

```
}

void minStackPop(MinStack* obj) {
    (*obj).top=(*obj).top-1;
}

int minStackTop(MinStack* obj) {
    return(*((*obj).stack+(*obj).top));
}

int minStackGetMin(MinStack* obj) {
    int i;
    int min=*((*obj).stack+0);
    for(i=1;i<=(*obj).top;i++)
    {
        if(*((*obj).stack+i)<min)
            min=*((*obj).stack+i);
    }
    return(min);
}

void minStackFree(MinStack* obj) {
    free(obj);
}
```

Output:



Lab program 5(a)

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 *head=NULL;
void push()
{
   struct Node *new_node=malloc(sizeof(struct Node));
   int data;
   printf("Enter the data to be entered ");
   scanf("%d",&data);
   (*new_node).data=data;
   (*new_node).next=head;
   head=new_node;

}
void append()
{
   struct Node *new_node=malloc(sizeof(struct Node));
```

```
    int data;
    struct Node *last=head;
    printf("Enter the data to be entered ");
    scanf("%d",&data);
    (*new_node).data=data;
    (*new_node).next=NULL;
    if(head==NULL)
       head=new_node;
    else
    {
       while((*last).next!=NULL)
       {
          last=(*last).next;
       }

       (*last).next=new_node;
    }
}
void insert_at_pos(int pos)
{
    struct Node *new_node=malloc(sizeof(struct Node));
    struct Node *temp=head;
    int data;
     printf("Enter the data to be entered ");
    scanf("%d",&data);
    (*new_node).data=data;
    if(pos==1)
```

```
    {
        (*new_node).next=head;
        head=new_node;
        return;
    }
    int position=1;
    while(1)
    {
        if(position==pos-1)
            break;
        else
        {
            temp=(*temp).next;
            position=position+1;
        }
    }
    (*new_node).next=(*temp).next;
    (*temp).next=new_node;
}
void Pop()
{
    if(head==NULL)
        printf("The linked list is empty. You cannot delete from an empty list.");
    else
    {
        struct Node *ptr=head;
        head=(*ptr).next;
```

```
        free(ptr);
    }
}
void End_delete()
{
    if(head==NULL)
        printf("The linked list is empty. You cannot delete from an empty list.");
    else if((*head).next==NULL)
    {
        free(head);
        head=NULL;
    }
    else
    {
        struct Node *ptr1=head;
        struct Node *ptr=(*ptr1).next;
        while((*ptr).next!=NULL)
        {
            ptr1=(*ptr1).next;
            ptr=(*ptr1).next;
        }
        (*ptr1).next=NULL;
        free(ptr);
    }
}
void Delete_at_pos(int pos)
{
```

```
if(head==NULL)
    printf("The linked list is empty. You cannot delete from an empty list.");
else if(pos==1)
{
    struct Node *ptr1=(*head).next;
    free(head);
    head=ptr1;
}
else
{
    int position=2;
    struct Node *ptr1=head;
    struct Node *ptr=(*ptr1).next;
    while(1)
    {
        if(ptr==NULL)
        {
            printf("There are less than required elements in the list.");
            return;
        }
        if(position==pos)
        {
            (*ptr1).next=(*ptr).next;
            free(ptr);
            break;
        }
        position=position+1;
```

```
            ptr1=(*ptr1).next;
            ptr=(*ptr1).next;
        }
    }
}
void display()
{
    struct Node *node=head;
    while(node!=NULL)
    {
        printf("%d ",(*node).data);
        node=(*node).next;
    }
}
void main()
{
    int choice;
    while(1)
    {
        printf("Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from  the middle, 7 to display the contents, and 8 to exit. ");
        scanf("%d",&choice);
        if(choice==1)
            push();
        else if(choice==2)
            append();
        else if(choice==3)
```

```
        {
            int position;
            printf("Enter the position to insert the node. ");
            scanf("%d",&position);
            insert_at_pos(position);
        }
        else if(choice==4)
            Pop();
        else if(choice==5)
            End_delete();
        else if(choice==6)
        {
            int position;
            printf("Enter the position to delete from the list. ");
            scanf("%d", &position);
            Delete_at_pos(position);
        }
        else if(choice==7)
            display();
        else if(choice==8)
            break;
        else
            printf("Invalid input entered.");
        printf("\n\n");
    }
}
```

Output:

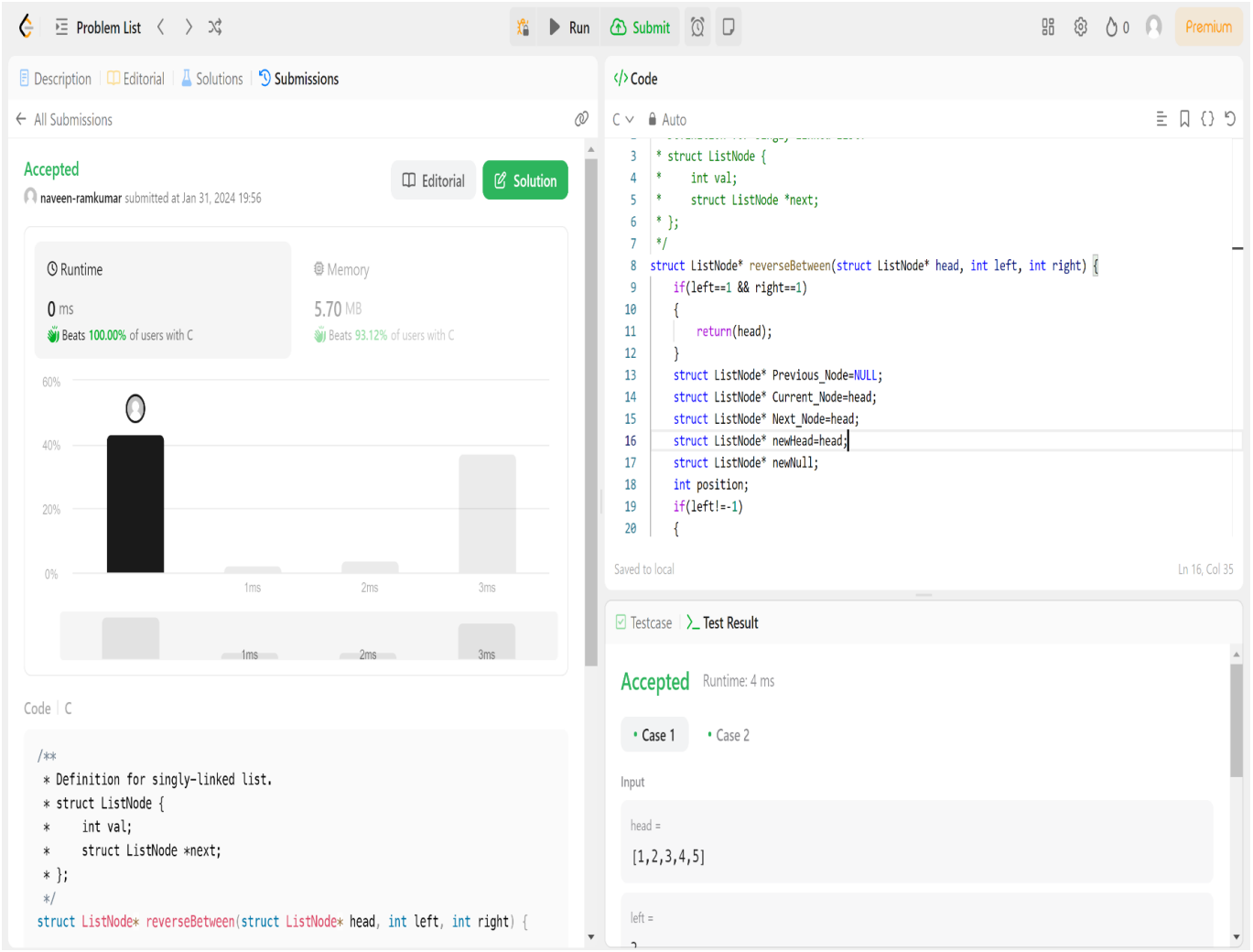
```
Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 7
100 200 300 400 500

Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 4


Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 7
200 300 400 500

Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 5


Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 7
200 300 400

Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 6
Enter the position to delete from the list. 4
There are less than required elements in the list.

Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 6
Enter the position to delete from the list. 2


Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 7
200 400

Enter 1 to insert at the beginning, 2 to append at the end, 3 to insert in the middle, 4 to delete from the beginning, 5 to delete from the end, 6 to delete from the middle, 7 to display the contents, and 8 to exit. 8

Process returned 8 (0x8)   execution time : 133.663 s
Press any key to continue.
```

Lab program 5(b)

Demonstration of LeetCode program on Singly linked list.

```
struct ListNode* reverseBetween(struct ListNode* head, int left, int right) {
    if(left==1 && right==1)
    {
        return(head);
    }
    struct ListNode* Previous_Node=NULL;
    struct ListNode* Current_Node=head;
    struct ListNode* Next_Node=head;
    struct ListNode* newHead=head;
    struct ListNode* newNull;
    int position;
    if(left!=-1)
    {
        for(position=1; position<left; position++)
        {
            if(position==left-1)
            {
                newHead=Current_Node;
            }
            Current_Node=(*Current_Node).next;
        }
    }
    Previous_Node=Current_Node;
    newNull=Current_Node;
    Current_Node=(*Current_Node).next;
    for(position=left+1; position<=right; position++)
    {
        Next_Node=(*Current_Node).next;
        (*Current_Node).next=Previous_Node;
        Previous_Node=Current_Node;
        if(position==right)
        {
            if(left==1)
            {
                head=Current_Node;
            }
            else
                (*newHead).next=Current_Node;
        }
        Current_Node=Next_Node;
    }
    (*newNull).next=Current_Node;
    return(head);
}
```

Output:


Problem List
Run
Submit
Premium
Description
Editorial
Solutions
Submissions
All Submissions
Accepted
naveen-ramkumar submitted at Jan 31, 2024 19:56
Editorial
Solution
Runtime
0 ms
Beats 100.00% of users with C
Memory
5.70 MB
Beats 93.12% of users with C
60%
40%
20%
0%
1ms
2ms
3ms
Code | C
/**
* Definition for singly-linked list.
* struct ListNode {
*   int val;
*   struct ListNode *next;
* };
*/
struct ListNode* reverseBetween(struct ListNode* head, int left, int right) {
Code
C
Auto
* struct ListNode {
*   int val;
*   struct ListNode *next;
* };
*/
struct ListNode* reverseBetween(struct ListNode* head, int left, int right) {
if(left==1 && right==1)
{
return(head);
}
struct ListNode* Previous_Node=NULL;
struct ListNode* Current_Node=head;
struct ListNode* Next_Node=head;
struct ListNode* newHead=head;
struct ListNode* newNull;
int position;
if(left!=-1)
{
Saved to local
Ln 16, Col 35
Testcase
Test Result
Accepted
Runtime: 4 ms
Case 1
Case 2
Input
head =
[1,2,3,4,5]
left =

Lab program 6(a)

WAP to Implement Single Linked 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;
};
struct Node* head=NULL;
struct Node* head2=NULL;
void sort(struct Node* head)
{
   struct Node* i;
   struct Node* j;
   int temp;
   printf("The linked list before sorting is:\n");
   display(head);
   for(i=head; (*i).next!=NULL; i=(*i).next)
   {
      for(j=(*i).next; (*j).next!=NULL; j=(*j).next)
      {
         if((*j).data<(*i).data)
         {
            temp=(*i).data;
            (*i).data=(*j).data;
```

```
            (*j).data=temp;
        }
    }
    printf("\nThe linked list after sorting is:\n");
    display(head);
}
void reverse(struct Node* head)
{
    struct Node* previous_Node=NULL;
    struct Node* current_Node=head;
    struct Node* next_Node;
    printf("The linked list before reversing is:\n");
    display(head);
    while(current_Node!=NULL)
    {
        next_Node=(*current_Node).next;
        if(next_Node==NULL)
        {
            head=current_Node;
        }
        (*current_Node).next=previous_Node;
        previous_Node=current_Node;
        current_Node=next_Node;
    }
    printf("\nThe linked list after reversing is:\n");
    display(head);
```

```
}
void concatenate(struct Node* head1, struct Node* head2)
{
   printf("The linked list 1 is:\n");
   display(head);
   printf("\nThe linked list 2 is:\n");
   display(head2);
   struct Node* last;
   for(last=head; (*last).next!=NULL; last=(*last).next);
   (*last).next=head2;
   printf("\nThe linked list 1 after concatenation is:\n");
   display(head);
}
void display(struct Node* head)
{
   struct Node* temp;
   for(temp=head; temp!=NULL; temp=(*temp).next)
   {
      printf("%d ", (*temp).data);
   }
}
void main()
{
   struct Node* New_Node;
   int position;
   int data;
   int choice;
```

```
while(1)
{
    head=NULL;
    head2=NULL;
    printf("List 1\n");
    for(position=1; position<=5; position++)
    {
        printf("Enter the data that you wish to enter for position %d. ", 6-position);
        scanf("%d",&data);
        struct Node* New_Node=malloc(sizeof(struct Node));
        (*New_Node).data=data;
        (*New_Node).next=head;
        head=New_Node;
    }
    printf("Enter 1 to sort the linked list, 2 to reverse the linked list, 3 to concatenate it with another linked list and 4 to exit. ");
    scanf("%d", &choice);
    if(choice==1)
        sort(head);
    else if(choice==2)
        reverse(head);
    else if(choice==3)
    {
        printf("List 2\n");
        for(position=1; position<=5; position++)
        {
            printf("Enter the data that you wish to enter for position %d. ", 6-position);
```

```
            scanf("%d",&data);
            struct Node* New_Node=malloc(sizeof(struct Node));
            (*New_Node).data=data;
            (*New_Node).next=head2;
            head2=New_Node;
        }
        concatenate(head, head2);
    }
    else if(choice==4)
        break;
    else
        printf("Invalid input character.");
    printf("\n\n");
  }
}
```

Output:

```
List 1
Enter the data that you wish to enter for position 5. 9
Enter the data that you wish to enter for position 4. 3
Enter the data that you wish to enter for position 3. 1
Enter the data that you wish to enter for position 2. 2
Enter the data that you wish to enter for position 1. 5
Enter 1 to sort the linked list, 2 to reverse the linked list, 3 to concatenate it with another linked list and 4 to exit. 1
The linked list before sorting is:
5 2 1 3 9
The linked list after sorting is:
1 2 3 5 9

List 1
Enter the data that you wish to enter for position 5. 9
Enter the data that you wish to enter for position 4. 3
Enter the data that you wish to enter for position 3. 1
Enter the data that you wish to enter for position 2. 2
Enter the data that you wish to enter for position 1. 5
Enter 1 to sort the linked list, 2 to reverse the linked list, 3 to concatenate it with another linked list and 4 to exit. 2
The linked list before reversing is:
5 2 1 3 9
The linked list after reversing is:
9 3 1 2 5

List 1
Enter the data that you wish to enter for position 5. 9
Enter the data that you wish to enter for position 4. 3
Enter the data that you wish to enter for position 3. 1
Enter the data that you wish to enter for position 2. 2
Enter the data that you wish to enter for position 1. 5
Enter 1 to sort the linked list, 2 to reverse the linked list, 3 to concatenate it with another linked list and 4 to exit. 3
List 2
Enter the data that you wish to enter for position 5. 7
Enter the data that you wish to enter for position 4. 6
Enter the data that you wish to enter for position 3. 3
Enter the data that you wish to enter for position 2. 1
Enter the data that you wish to enter for position 1. 9
The linked list 1 is:
5 2 1 3 9
The linked list 2 is:
9 1 3 6 7
The linked list 1 after concatenation is:
5 2 1 3 9 9 1 3 6 7

List 1
```

```
List 1
Enter the data that you wish to enter for position 5. 4
Enter the data that you wish to enter for position 4. 5
Enter the data that you wish to enter for position 3. 3
Enter the data that you wish to enter for position 2. 2
Enter the data that you wish to enter for position 1. 1
Enter 1 to sort the linked list, 2 to reverse the linked list, 3 to concatenate it with another linked list and 4 to exit. 4

Process returned 4 (0x4)   execution time : 103.886 s
Press any key to continue.
```

Lab Program 6(b)

WAP to Implement Single Linked List to simulate Stack operations

```
#include <stdio.h>
#include <stdlib.h>
#define SIZE 20
int top=0;
struct Node
{
   int data;
   struct Node *next;
};
struct Node *head=NULL;
void push()
{
   if(top==SIZE)
   {
      printf("Stack overflow. Cannot insert more elements into the stack.");
   }
   else
   {
      struct Node *new_node=malloc(sizeof(struct Node));
      int data;
      struct Node *last=head;
```

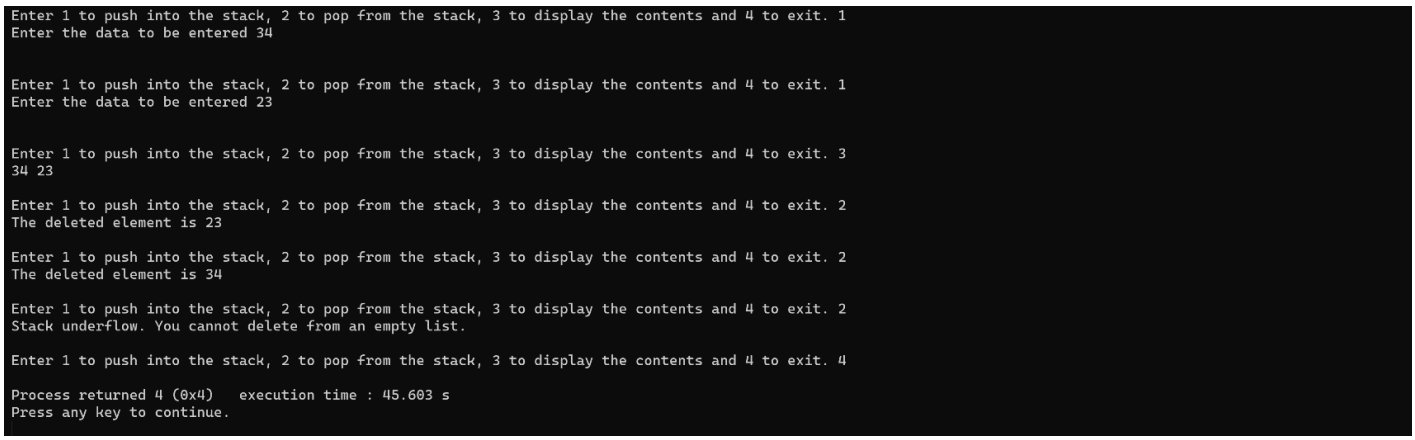
```
        printf("Enter the data to be entered ");
        scanf("%d",&data);
        (*new_node).data=data;
        (*new_node).next=NULL;
        if(head==NULL)
        {
           head=new_node;
        }
        else
        {
           while((*last).next!=NULL)
           {
              last=(*last).next;
           }
           (*last).next=new_node;
        }
        top=top+1;
    }
}
void pop()
{
    if(top==0)
        printf("Stack underflow. You cannot delete from an empty list.");
    else
    {
        int deleted_node;
        if((*head).next==NULL)
```

```
        {
            deleted_node=(*head).data;
            free(head);
            head=NULL;
        }
        else
        {
            struct Node *ptr1=head;
            struct Node *ptr=(*ptr1).next;
            while((*ptr).next!=NULL)
            {
                ptr1=(*ptr1).next;
                ptr=(*ptr1).next;
            }
            (*ptr1).next=NULL;
            deleted_node=(*ptr).data;
            free(ptr);
        }
        top=top-1;
        printf("The deleted element is %d", deleted_node);
    }
}
void display()
{
    if(top==0)
    {
        printf("Stack undeflow. Cannot display the contents of an empty stack.");
```

```
    }
    else
    {
        struct Node *node=head;
        while(node!=NULL)
        {
            printf("%d ",(*node).data);
            node=(*node).next;
        }
    }
}
void main()
{
    while(1)
    {
        printf("Enter 1 to push into the stack, 2 to pop from the stack, 3 to display the contents and 4 to exit. ");
        int ch;
        scanf("%d",&ch);
        if(ch==1)
        {
            push();
        }
        else if(ch==2)
        {
            pop();
        }
```

```
        else if(ch==3)
        {
            display();
        }
        else if(ch==4)
        {
            break;
        }
        else
        {
            printf("Invalid character.");
        }
        printf("\n\n");
    }
}
```

Output:



Lab Program 6(b)

WAP to Implement Single Linked List to simulate Queue Operations.

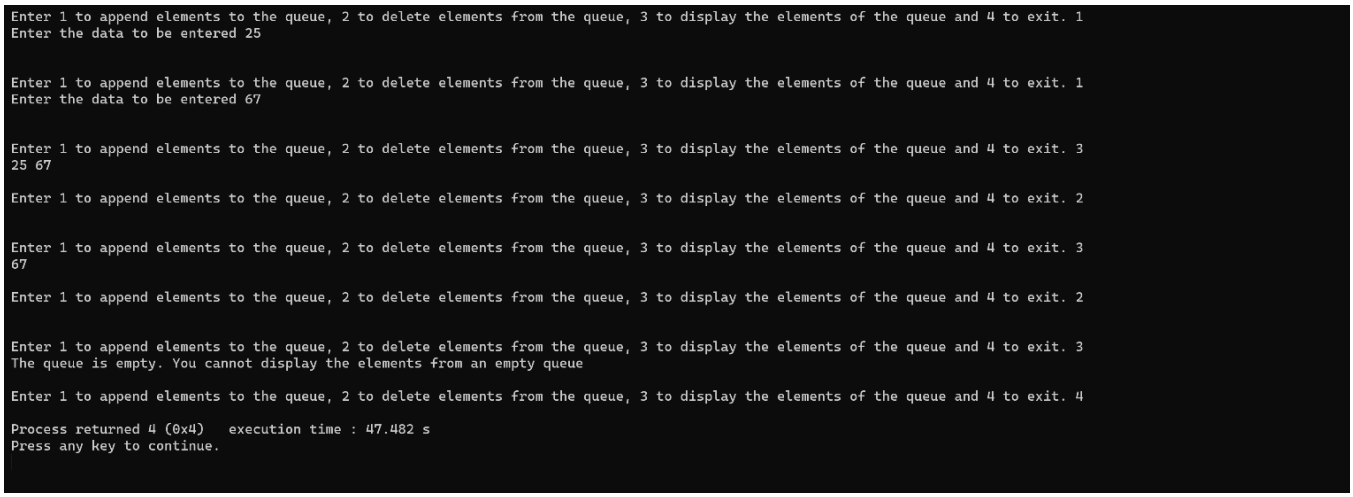
```
#include <stdio.h>
#include <stdlib.h>
#define MAX 20
struct Node
{
   int data;
   struct Node *next;
};
struct Node *head=NULL;
int rear=-1;
void append()
{
   if(rear==MAX-1)
   {
      printf("Queue overflow");
   }
   else
   {
      rear=rear+1;
      struct Node *new_node=malloc(sizeof(struct Node));
      int data;
```

```
        struct Node *last=head;
        printf("Enter the data to be entered ");
        scanf("%d",&data);
        (*new_node).data=data;
        (*new_node).next=NULL;
        if(head==NULL)
           head=new_node;
        else
        {
           while((*last).next!=NULL)
           {
              last=(*last).next;
           }

           (*last).next=new_node;
        }
    }
}
void Pop()
{
    if(head==NULL)
        printf("The queue is empty. You cannot delete from an empty queue");
    else
    {
        struct Node *ptr=head;
        head=(*ptr).next;
        free(ptr);
```

```
    }
}
void display()
{
    if(head==NULL)
        printf("The queue is empty. You cannot display the elements from an empty queue");
    else
    {
        struct Node *node=head;
        while(node!=NULL)
        {
            printf("%d ",(*node).data);
            node=(*node).next;
        }
    }
}
void main()
{
    while(1)
    {
        printf("Enter 1 to append elements to the queue, 2 to delete elements from the queue, 3 to display the elements of the queue and 4 to exit. ");
        int ch;
        scanf("%d", &ch);
        if(ch==1)
        {
            append();
```

```
        }
        else if(ch==2)
        {
            Pop();
        }
        else if(ch==3)
        {
            display();
        }
        else if(ch==4)
        {
            break;
        }
        else
        {
            printf("Invalid character");
        }
        printf("\n\n");
    }
}
```

Output:



Lab program 7(a)

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 *next;

   struct Node *previous;

};
```

```
struct Node *head=NULL;
void insert(int position)
{
   int pos;
   struct Node *node=head;
   for(pos=1; pos<=position; pos++)
   {
      if(node==NULL && !(head==NULL && position==1))
      {
         printf("The given position is longer than the linked list. Please enter another position.");
         return;
      }
      if(pos==position)
      {
         break;
      }
      node=(*node).next;
   }
   int data;
   printf("Enter the data to be entered in the new node ");
   scanf("%d", &data);
   struct Node *newNode;
   newNode=malloc(sizeof(struct Node));
   (*newNode).data=data;
   (*newNode).next=node;
   if(head==NULL)
```

```
    {
        (*newNode).previous=NULL;
        head=newNode;
    }
    else{
        (*newNode).previous=(*node).previous;
        struct Node *previous;
        previous=(*node).previous;
        (*node).previous=newNode;
        if(previous==NULL)
        {
            head=newNode;
        }
        else
        {
            (*previous).next=newNode;
        }
    }

}
void delete_based_on_a_value(int value)
{
    struct Node *node=head;
    int first_time=1;
    while(1)
    {
        if(node==NULL)
```

```
{
   printf("Cannot delete from an empty list.");
   return;
}
for(node=head; node!=NULL; node=(*node).next)
{
   if((*node).data==value)
   {
      break;
   }
}
if(node==NULL)
{
   if(first_time==1)
   {
      printf("The node with the given value is not found in the linked list.");
   }
   return;
}
else
{
   if((*node).previous==NULL)
   {
      head=(*node).next;
   }
   else
   {
```

```
            (*(*node).previous).next=(*node).next;
        }
        if((*node).next!=NULL)
        {
            (*(*node).next).previous=(*node).previous;
        }
        free(node);
    }
    first_time=0;
  }

}
void display()
{
  if(head==NULL)
  {
    printf("The linked list is empty.");
  }
  else
  {
    struct Node *node;
    for(node=head; node!=NULL; node=(*node).next)
    {
      printf("%d ", (*node).data);
    }
  }
}
```

```
void main()
{
   while(1)
   {
      int ch;
      printf("Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. ");
      scanf("%d", &ch);
      if(ch==1)
      {
         int data, position;
         printf("Enter the position to the left of which you want to enter the data. ");
         scanf("%d", &position);
         insert(position);
      }
      else if(ch==2)
      {
         int value;
         printf("Enter the value for which you want to delete from the linked list. ");
         scanf("%d", &value);
         delete_based_on_a_value(value);
      }
      else if(ch==3)
         display();
      else if(ch==4)
      {
         break;
```

```
        }
        else
        {
            printf("Invalid character");
        }
        printf("\n\n");
    }
}
```

Output:

```
Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 1
Enter the position to the left of which you want to enter the data. 3
The given position is longer than the linked list. Please enter another position.

Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 1
Enter the position to the left of which you want to enter the data. 1
Enter the data to be entered in the new node 45


Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 1
Enter the position to the left of which you want to enter the data. 1
Enter the data to be entered in the new node 34


Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 1
Enter the position to the left of which you want to enter the data. 1
Enter the data to be entered in the new node 23


Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 3
23 34 45

Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 1
Enter the position to the left of which you want to enter the data. 3
Enter the data to be entered in the new node 23


Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 1
Enter the position to the left of which you want to enter the data. 1
Enter the data to be entered in the new node 23


Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 3
23 23 34 23 45

Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 2
Enter the value for which you want to delete from the linked list. 23


Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 3
34 45

Enter 1 to insert, 2 to delete an element based on its value, 3 to display the elements of the linked list and 4 to exit. 4

Process returned 4 (0x4)   execution time : 92.693 s
```

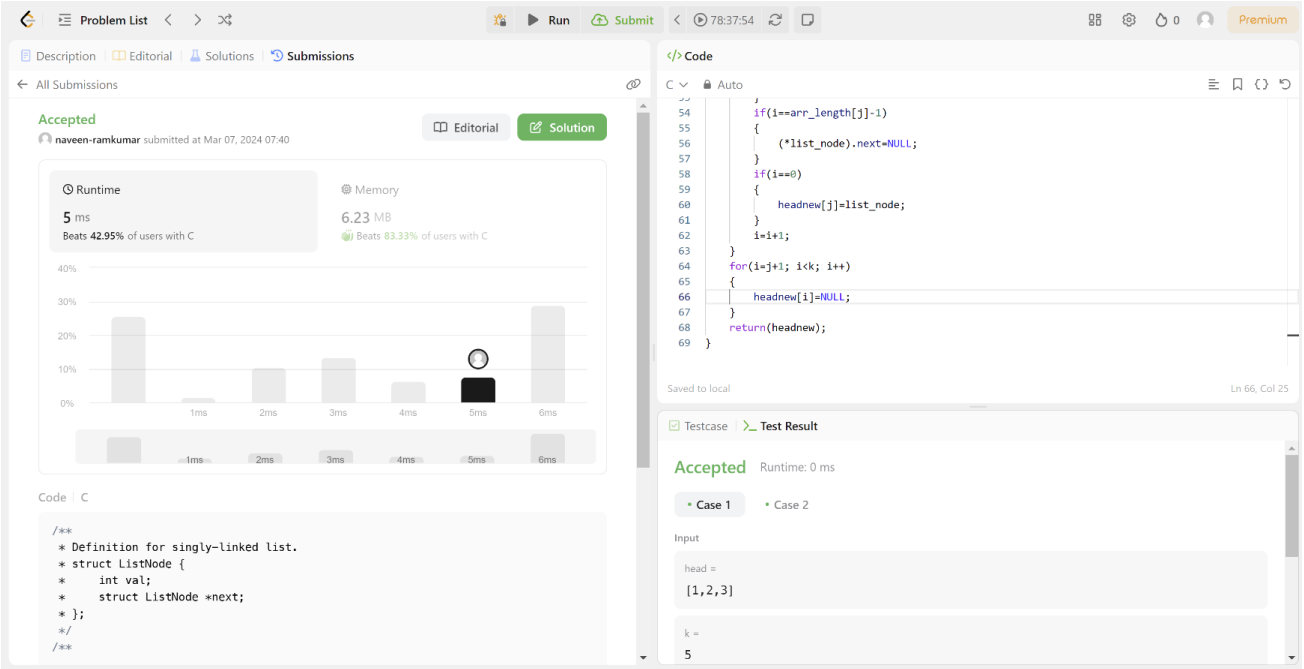
Lab program 7(b)

Demonstration of LeetCode program on Singly linked list

```
struct ListNode** splitListToParts(struct ListNode* head, int k, int* returnSize) {
   *returnSize=k;
   struct ListNode** headnew;
   headnew=malloc(k*sizeof(struct ListNode*));
   int i;
   if(head==NULL)
   {
      for(i=0; i<k; i++)
      {
         headnew[i]=NULL;
      }
      return(headnew);
   }
   int list_length=0;
   struct ListNode* list_node;
   for(list_node=head; list_node!=NULL; list_node=(*list_node).next)
   {
      list_length=list_length+1;
   }
   int arr_length[k];
   for(i=0; i<k; i++)
   {
      if(i<list_length-(list_length/k)*k)
      {
         arr_length[i]=(list_length/k)+1;
      }
      else
      {
         arr_length[i]=(list_length/k);
      }
   }
   list_node=head;
   struct ListNode *array;
   int j=0;
   i=0;
   for(list_node=head; list_node!=NULL; list_node=array)
   {
      array=(*list_node).next;
      if(i==arr_length[j])
      {
         i=0;
         j=j+1;
      }
```

```
        if(i==arr_length[j]-1)
        {
           (*list_node).next=NULL;
        }
        if(i==0)
        {
           headnew[j]=list_node;
        }
        i=i+1;
    }
    for(i=j+1; i<k; i++)
    {
       headnew[i]=NULL;
    }
    return(headnew);
}
```

Output:



Lab program 8(a)

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 postorder
c. To display the elements in the tree.

```
#include <stdio.h>
#include <stdlib.h>
struct Node
{
   int data;
   struct Node *left;
   struct Node *right;
};
struct Node *root=NULL;
void inorder(struct Node *root)
{
   if(root!=NULL)
   {
      inorder((*root).left);
      printf("%d ", (*root).data);
      inorder((*root).right);
   }
   else
   {
      return;
   }
```

```
}
void preorder(struct Node *root)
{
   if(root!=NULL)
   {
      printf("%d ", (*root).data);
      preorder((*root).left);
      preorder((*root).right);
   }
   else
   {
      return;
   }
}
void postorder(struct Node *root)
{
   if(root!=NULL)
   {
      postorder((*root).left);
      postorder((*root).right);
      printf("%d ", (*root).data);
   }
   else
   {
      return;
   }
}
```

```
void insert(int value)
{
   struct Node *temp=root;
   struct Node *new_node=malloc(sizeof(struct Node));
   while(temp!=NULL)
   {
      if(value<(*temp).data)
      {
         if((*temp).left==NULL)
         {
            (*temp).left=new_node;
            break;
         }
         else
         {
            temp=(*temp).left;
         }
      }
      else
      {
         if((*temp).right==NULL)
         {
            (*temp).right=new_node;
            break;
         }
         else
         {
```

```
            temp=(*temp).right;
        }
    }
}
(*new_node).data=value;
(*new_node).left=NULL;
(*new_node).right=NULL;
if(root==NULL)
{
    root=new_node;
}
}
void main()
{
  while(1)
  {
    printf("Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. ");
    int choice;
    scanf("%d", &choice);
    if(choice==1)
    {
      printf("Enter the value to insert. ");
      int value;
      scanf("%d", &value);
      insert(value);
    }
```

```
        else if(choice==2)
        {
            preorder(root);
        }
        else if(choice==3)
        {
            inorder(root);
        }
        else if(choice==4)
        {
            postorder(root);
        }
        else if(choice==5)
        {
            break;
        }
        else
        {
            printf("Invalid character.");
        }
        printf("\n\n");
    }
}
```

Output:

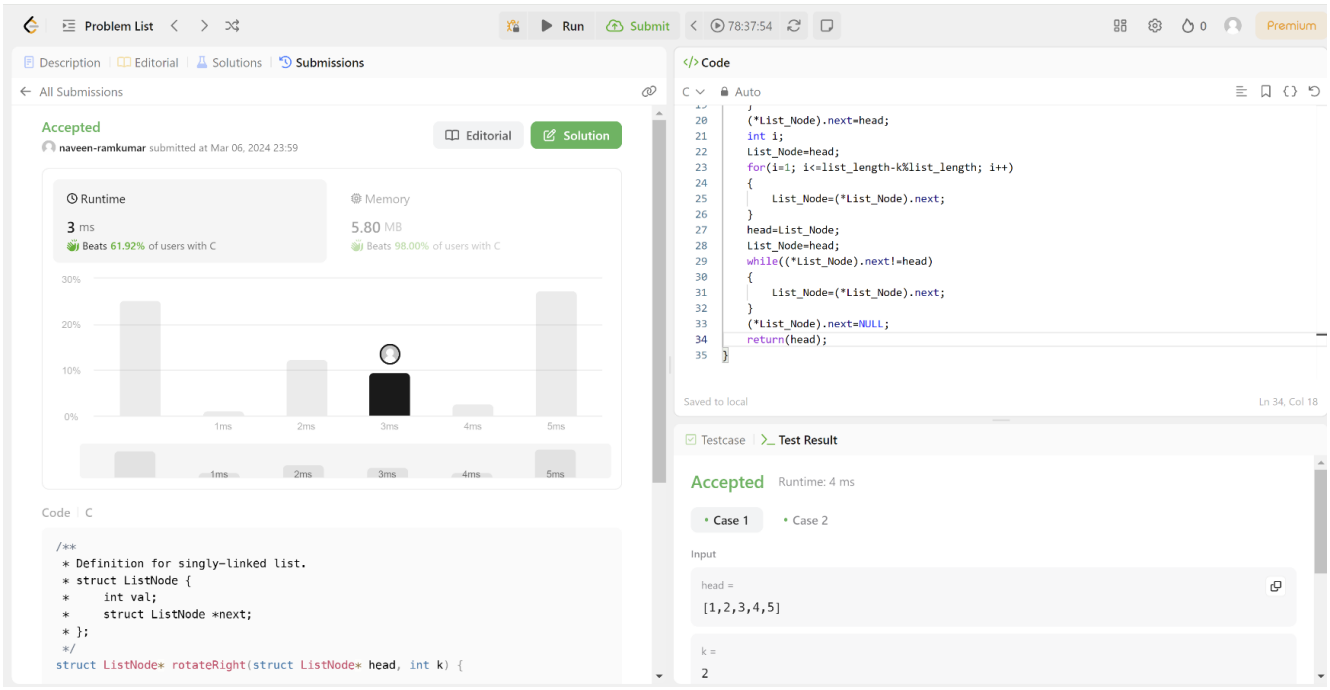
```
Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 1
Enter the value to insert. 100


Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 1
Enter the value to insert. 20


Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 1
Enter the value to insert. 10


Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 1
Enter the value to insert. 30


Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 1
Enter the value to insert. 200


Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 1
Enter the value to insert. 150


Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 1
Enter the value to insert. 300


Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 2
100 20 10 30 200 150 300

Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 3
10 20 30 100 150 200 300

Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 4
10 30 20 150 300 200 100

Enter 1 to insert the elements into the tree, 2 to do preorder traversal, 3 to do inorder traversal, 4 to do postorder traversal and 5 to exit. 5

Process returned 5 (0x5)   execution time : 70.125 s
Press any key to continue.
```

Lab program 8(b)

Leet code on Linked list

```
struct ListNode* rotateRight(struct ListNode* head, int k) {
    if(head==NULL)
    {
        return(head);
    }
    struct ListNode* List_Node=head;
    int list_length=1;
    while((*List_Node).next!=NULL)
    {
        list_length=list_length+1;
        List_Node=(*List_Node).next;
    }
    (*List_Node).next=head;
    int i;
    List_Node=head;
    for(i=1; i<=list_length-k%list_length; i++)
    {
        List_Node=(*List_Node).next;
    }
    head=List_Node;
    List_Node=head;
    while((*List_Node).next!=head)
    {
        List_Node=(*List_Node).next;
    }
    (*List_Node).next=NULL;
    return(head);
}
```

Output:


Problem List
Run
Submit
78:37:54
Premium
Description
Editorial
Solutions
Submissions
All Submissions
Accepted
naveen-ramkumar submitted at Mar 06, 2024 23:59
Editorial
Solution
Runtime
3 ms
Beats 61.92% of users with C
Memory
5.80 MB
Beats 98.00% of users with C
30%
20%
10%
0%
1ms
2ms
3ms
4ms
5ms
Code
C
/**
* Definition for singly-linked list.
* struct ListNode {
*   int val;
*   struct ListNode *next;
* };
*/
struct ListNode* rotateRight(struct ListNode* head, int k) {
Code
C
Auto
(*List_Node).next=head;
int i;
List_Node=head;
for(i=1; i<=list_length-k%list_length; i++)
{
List_Node=(*List_Node).next;
}
head=List_Node;
List_Node=head;
while((*List_Node).next!=head)
{
List_Node=(*List_Node).next;
}
(*List_Node).next=NULL;
return(head);
}
Saved to local
Ln 34, Col 18
Testcase
Test Result
Accepted
Runtime: 4 ms
Case 1
Case 2
Input
head =
[1,2,3,4,5]
k =
2

Lab program 9

Write a program to traverse a graph using BFS method.
Write a program to check whether given graph is connected or not using DFS method.

```
#include <stdio.h>
int adjacency_matrix[20][20];
int visited[20];
int n;
void depth_first_search(int v)
{
   int i;
   visited[v]=1;
   for(i=0; i<7; i++)
        if(adjacency_matrix[v][i] && !visited[i])
        {
           printf("\n %d->%d",v,i);
           depth_first_search(i);
        }
}
int main()
{
   int i, j, count=0;
   printf("\n Enter number of vertices:");
   scanf("%d", &n);
```

```
    for(i=0; i<n; i++)
    {
        visited[i]=0;
        for(j=0; j<n; j++)
            adjacency_matrix[i][j]=0;
    }
    printf("Enter the adjacency matrix:\n");
    for(i=0; i<n; i++)
    {
        for(j=0; j<n; j++)
            scanf("%d", &adjacency_matrix[i][j]);
    }
    depth_first_search(0);
    printf("\n");
    for(i=0; i<n; i++)
    {
        if(visited[i])
            count++;
    }
    if(count==n)
        printf("Graph is connected");
    else
        printf("Graph is not connected");
    return 0;
}
```

Output:

```
 Enter number of vertices:7
Enter the adjacency matrix:
0 1 0 1 0 0 0
1 0 1 1 0 1 0
0 1 0 1 1 1 0
1 1 1 0 1 0 0
0 0 1 1 0 0 1
0 1 1 0 0 0 0
0 1 0 0 1 0 0

 0->1
 1->2
 2->3
 3->4
 4->6
 2->5
Graph is connected
Process returned 0 (0x0)   execution time : 50.338 s
Press any key to continue.
```

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>

#define TABLE_SIZE 7

void insert_into_hash_table(int hash_table[], int key)

{

   int hashkey;

   hashkey=key%TABLE_SIZE;

   int i=0;

   int isalreadypresent=0;

   while(i<TABLE_SIZE)

   {

      if(hash_table[hashkey]==key)

      {
```

```
            isalreadypresent=1;
            break;
        }
        if(hash_table[hashkey]==-1)
        {
            hash_table[hashkey]=key;
            printf("The key %d is inserted in position %d of the hash table.\n", key, hashkey);
            break;
        }
        else
        {
            hashkey=(hashkey+1)%TABLE_SIZE;
            i=i+1;
        }
    }
    if(i==TABLE_SIZE)
    {
        printf("The hash table is full.\n");
    }
    else if(isalreadypresent==1)
    {
        printf("The given element already exists in the table.");
    }
}
void search_the_hash_table(int hash_table[], int key)
{
    int hashkey;
```

```
    hashkey=key%TABLE_SIZE;
    int i=0;
    while(i<TABLE_SIZE)
    {
        if(hash_table[hashkey]==key)
        {
            printf("The key %d is found in position %d in the hash table.\n", key, hashkey);
            break;
        }
        else
        {
            hashkey=(hashkey+1)%TABLE_SIZE;
            i=i+1;
        }
    }
    if(i==TABLE_SIZE)
    {
        printf("The element is not found.\n");
    }
}
void main()
{
    int hash_table[TABLE_SIZE];
    int i;
    for(i=0; i<TABLE_SIZE; i++)
    {
        hash_table[i]=-1;
```

```
    }
    while(1)
    {
        int key;
        int choice;
        printf("Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. ");
        scanf("%d", &choice);
        if(choice==1)
        {
            printf("Enter a key to enter into the hash table ");
            scanf("%d", &key);
            insert_into_hash_table(hash_table, key);
        }
        else if(choice==2)
        {
            printf("Enter a key to search in the hash table ");
            scanf("%d", &key);
            search_the_hash_table(hash_table, key);
        }
        else if(choice==3)
        {
            break;
        }
        else
        {
            printf("Invalid character.");
```

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

Output:

```
Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 1
Enter a key to enter into the hash table 700
The key 700 is inserted in position 0 of the hash table.


Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 1
Enter a key to enter into the hash table 50
The key 50 is inserted in position 1 of the hash table.


Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 1
Enter a key to enter into the hash table 85
The key 85 is inserted in position 2 of the hash table.


Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 1
Enter a key to enter into the hash table 92
The key 92 is inserted in position 3 of the hash table.


Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 1
Enter a key to enter into the hash table 73
The key 73 is inserted in position 4 of the hash table.


Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 176
Invalid character.

Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 1
Enter a key to enter into the hash table 76
The key 76 is inserted in position 6 of the hash table.


Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 1
Enter a key to enter into the hash table 101
The key 101 is inserted in position 5 of the hash table.


Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 2
Enter a key to search in the hash table 92
The key 92 is found in position 3 in the hash table.


Enter 1 to enter a key into the hash table and 2 to search for a key in the hash table and 3 to exit. 3

Process returned 3 (0x3)   execution time : 130.615 s
```