VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.

LAB REPORT
on

Data Structures using C

Submitted by

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in partial fulfillment for the award of the degree of
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in
COMPUTER SCIENCE AND ENGINEERING

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B. M. S. College of Engineering,

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(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**Data Structures using C**" carried out by **SANJANA SHETTY (1BM22CS238),** 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

CO1	Apply the concept of linear and nonlinear data structures.
CO2	Analyse data structure operations for a given problem.
CO3	CO3 Design and implement operations of linear and nonlinear data structure.
CO4	Conduct practical experiments for demonstrating the operations of different data structures and sorting techniques.

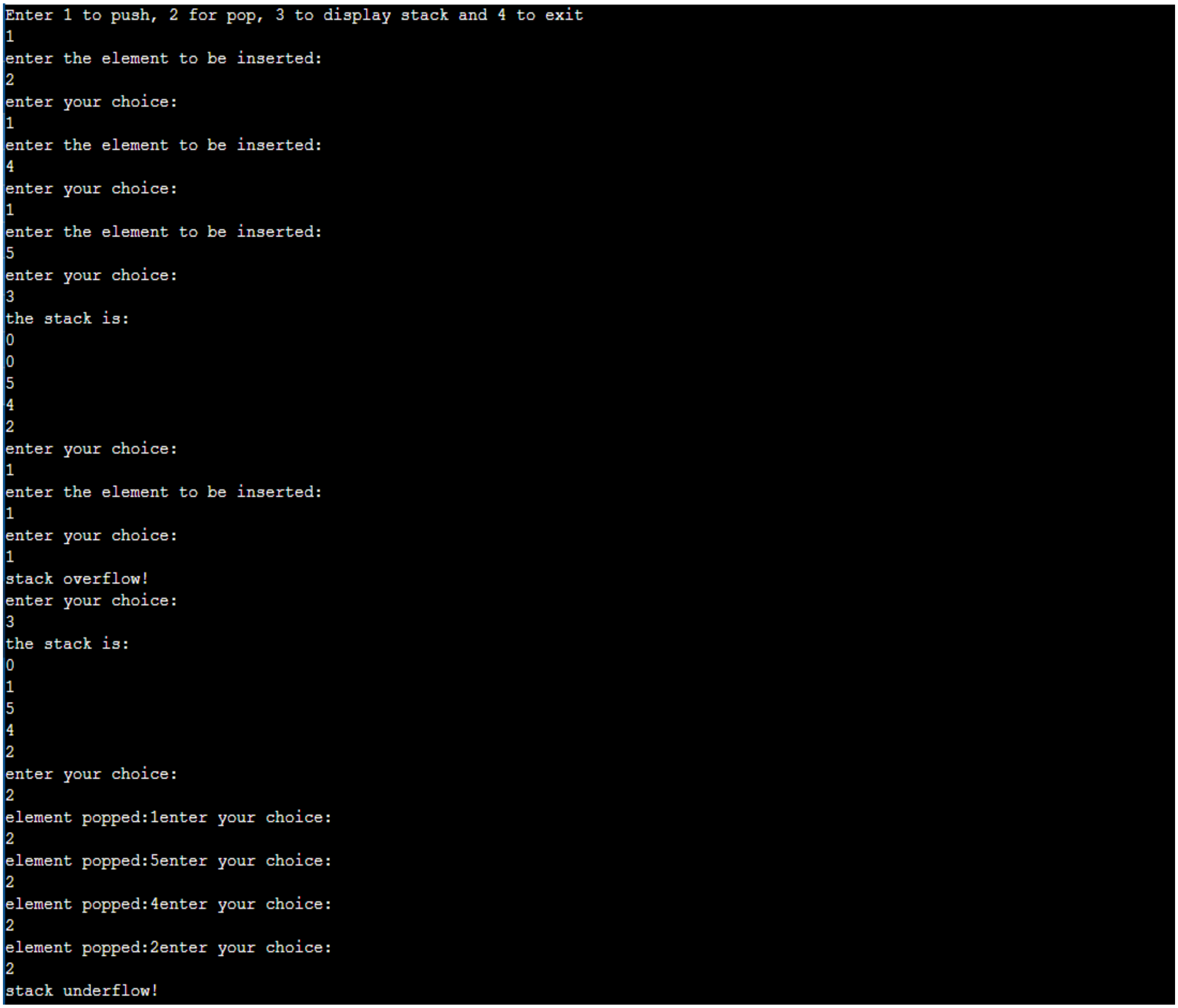
LAB 1

1. Write a program to simulate the working of stack using an array with the following : a) Push b) Pop c) Display

```
#include <stdio.h>
#include <stdlib.h>
int N;
#define N 4
int stack[N];
int top=-1;

void push(){
   if(top>=N-1){
      printf("stack overflow!\n");
   }
   else{
   int ele;
   printf("enter the element to be inserted:\n");
   scanf("%d",&ele);
   top++;
   stack[top]=ele;
   }
}

void pop(){
   if(top<0){
      printf("stack underflow!\n");
```

```
    }
    else{
    printf("element popped:%d",stack[top]);
    top--;
    }
}
void display(){
    int i;
    printf("the stack is:\n");
    for(i=N;i>=0;i--){
        printf("%d\n",stack[i]);
    }
    i=0;
}

void main(){
    int choice;
    printf("Enter 1 to push, 2 for pop, 3 to display stack and 4 to exit\n");
    scanf("%d",&choice);
    while(1){
    switch(choice){
        case 1: push();
                break;
        case 2: pop();
                break;
        case 3: display();
                break;
        case 4: exit(0);
                break;
        default: printf("enter valid input!\n");
    }
    printf("enter your choice:\n");
    scanf("%d",&choice);
    }
}
```

OUTPUT:



```
Enter 1 to push, 2 for pop, 3 to display stack and 4 to exit
1
enter the element to be inserted:
2
enter your choice:
1
enter the element to be inserted:
4
enter your choice:
1
enter the element to be inserted:
5
enter your choice:
3
the stack is:
0
0
5
4
2
enter your choice:
1
enter the element to be inserted:
1
enter your choice:
1
stack overflow!
enter your choice:
3
the stack is:
0
1
5
4
2
enter your choice:
2
element popped:1enter your choice:
2
element popped:5enter your choice:
2
element popped:4enter your choice:
2
element popped:2enter your choice:
2
stack underflow!
```

LAB 2

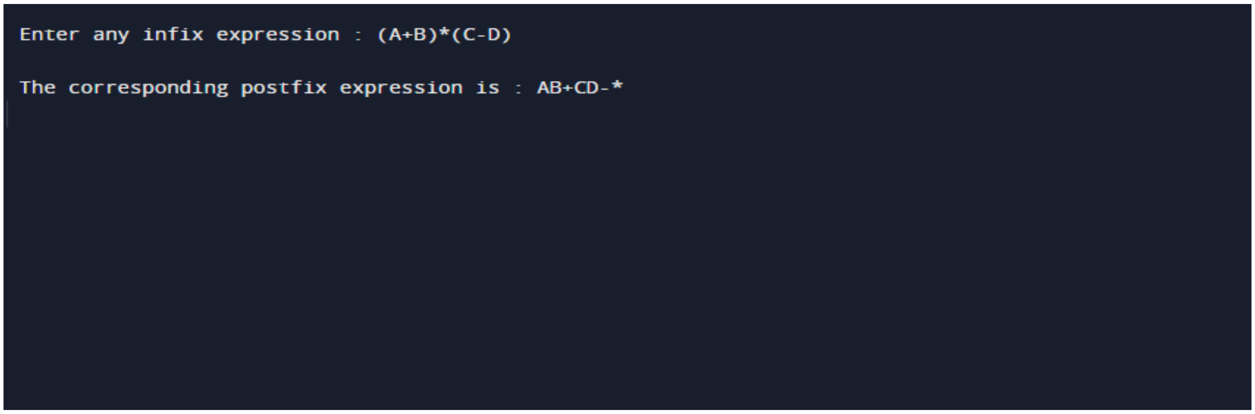
2. **a) WAP to convert a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide)**

a)

```
#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);


void main()

{

   char infix[100], postfix[100];
```

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

void InfixtoPostfix(char source[], char target[])
{
    int i = 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)
            {
                printf("\n INCORRECT 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] == '%' || 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("\n INCORRECT 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 == '*' || op == '%')
        return 1;
    else if (op == '+' || op == '-')
        return 0;
}
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("\n STACK UNDERFLOW");
    else
    {
        val = st[top];
        top--;
    }
    return val;
}
```

OUTPUT:



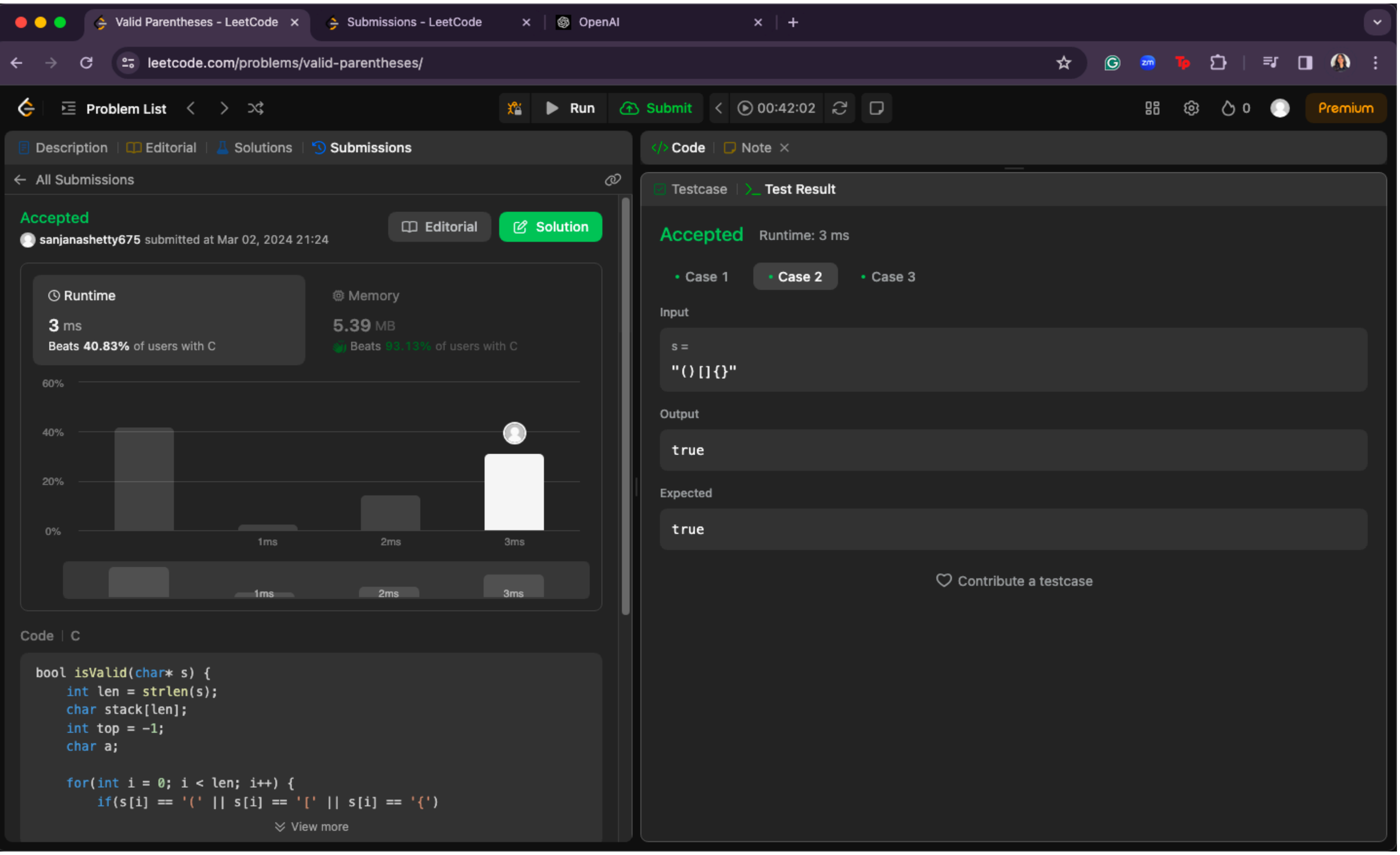
```
Enter any infix expression : (A+B)*(C-D)

The corresponding postfix expression is : AB+CD-*
```

2b) Leetcode Question - Valid parentheses

```
bool isValid(char* s) {
    int len = strlen(s);
    char stack[len];
    int top = -1;
    char a;

    for(int i = 0; i < len; i++) {
        if(s[i] == '(' || s[i] == '[' || s[i] == '{')
            stack[++top] = s[i];
        else {
            if(top == -1)
                return false;
            else {
                a = stack[top];
                if((a == '(' && s[i] == ')') || (a == '[' && s[i] == ']') || (a == '{' && s[i] == '}'))
                    top--;
                else
                    return false;
            }
        }
    }
    if(top == -1)
        return true;
    else
```

```
        return false;

}
```

OUTPUT:



Accepted
sanjanashetty675 submitted at Mar 02, 2024 21:24

Runtime
3 ms
Beats 40.83% of users with C

Memory
5.39 MB
Beats 93.13% of users with C

Code | C

```
bool isValid(char* s) {
    int len = strlen(s);
    char stack[len];
    int top = -1;
    char a;

    for(int i = 0; i < len; i++) {
        if(s[i] == '(' || s[i] == '[' || s[i] == '{')
```

Accepted Runtime: 3 ms

Case 1 Case 2 Case 3

Input

s =
"()[]{}"

Output

true

Expected

true

LAB 3

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

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

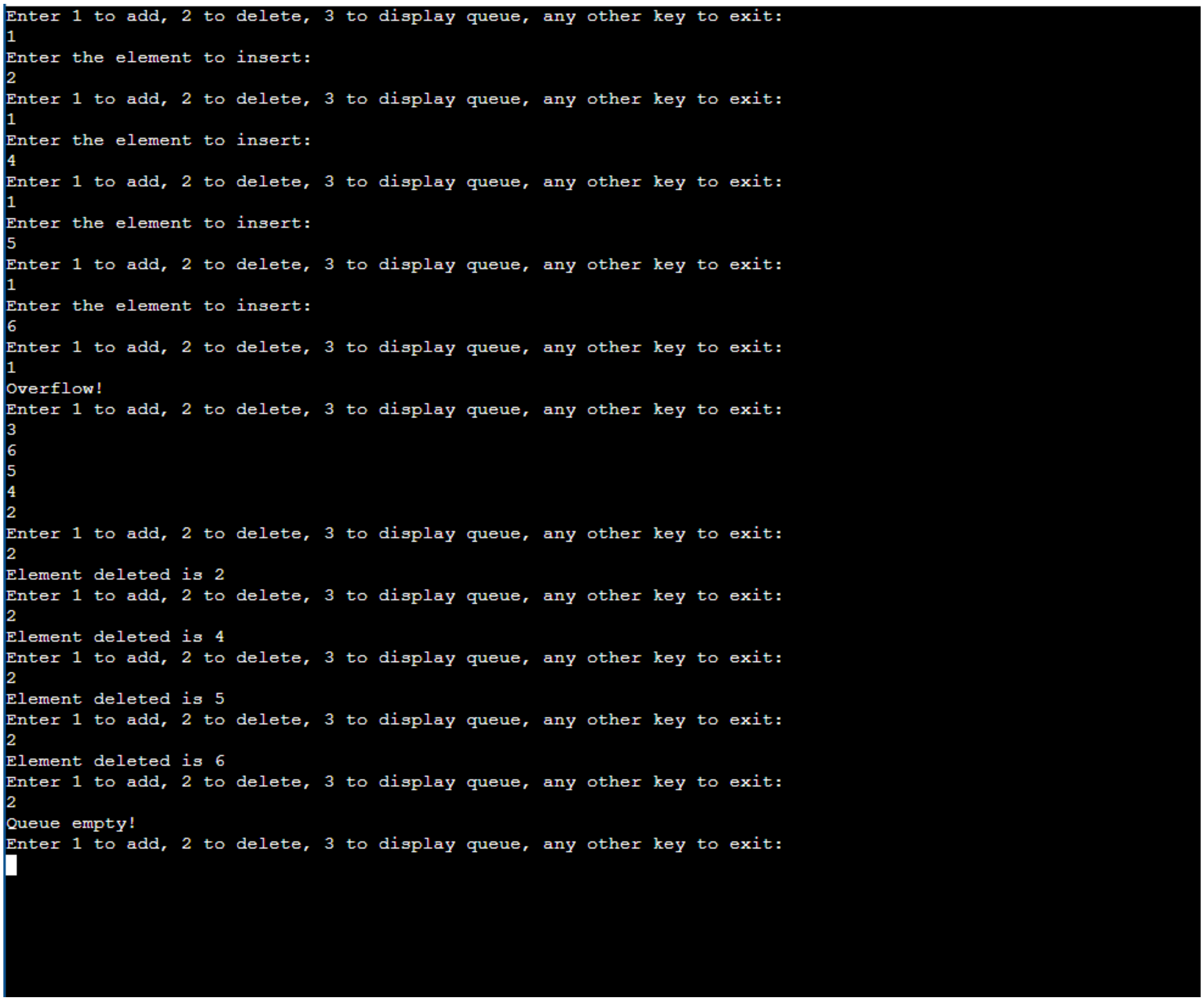
The program should print appropriate messages for queue empty and queue overflow conditions

a)

```
#include <stdio.h>
#include <stdlib.h>
#define N 4

int q[N];
int REAR = -1;
int FRONT = -1;

void enq();
void deq();
void display();

void enq() {
    if (REAR == N - 1) {
        printf("Overflow!\n");
    } else {
        int item;
        printf("Enter the element to insert:\n");
        scanf("%d", &item);
        if (REAR == -1 && FRONT == -1) {
            REAR++;
            q[REAR]=item;
            FRONT++;
        }
        else{
        REAR++;
        q[REAR] = item;
        }
    }
}

void deq() {
    int val;
    if (FRONT == -1 || FRONT > REAR) {
        printf("Queue empty!\n");
    } else {
        val = q[FRONT];
        FRONT++;
        printf("Element deleted is %d\n", val);
    }
}

void display() {
    int i;
    for (i = REAR; i >= FRONT; i--) {
        printf("%d\n", q[i]);
    }
}

int main() {
    int choice;
    while (1) {
        printf("Enter 1 to add, 2 to delete, 3 to display queue, any other key to
exit:\n");
        scanf("%d", &choice);
        switch (choice) {
            case 1:
```

```
          enq();
          break;
        case 2:
          deq();
          break;
        case 3:
          display();
          break;
        default:
          printf("Invalid key entered\n");
          exit(1);
      }
    }
    return 0;
}
```

OUTPUT:



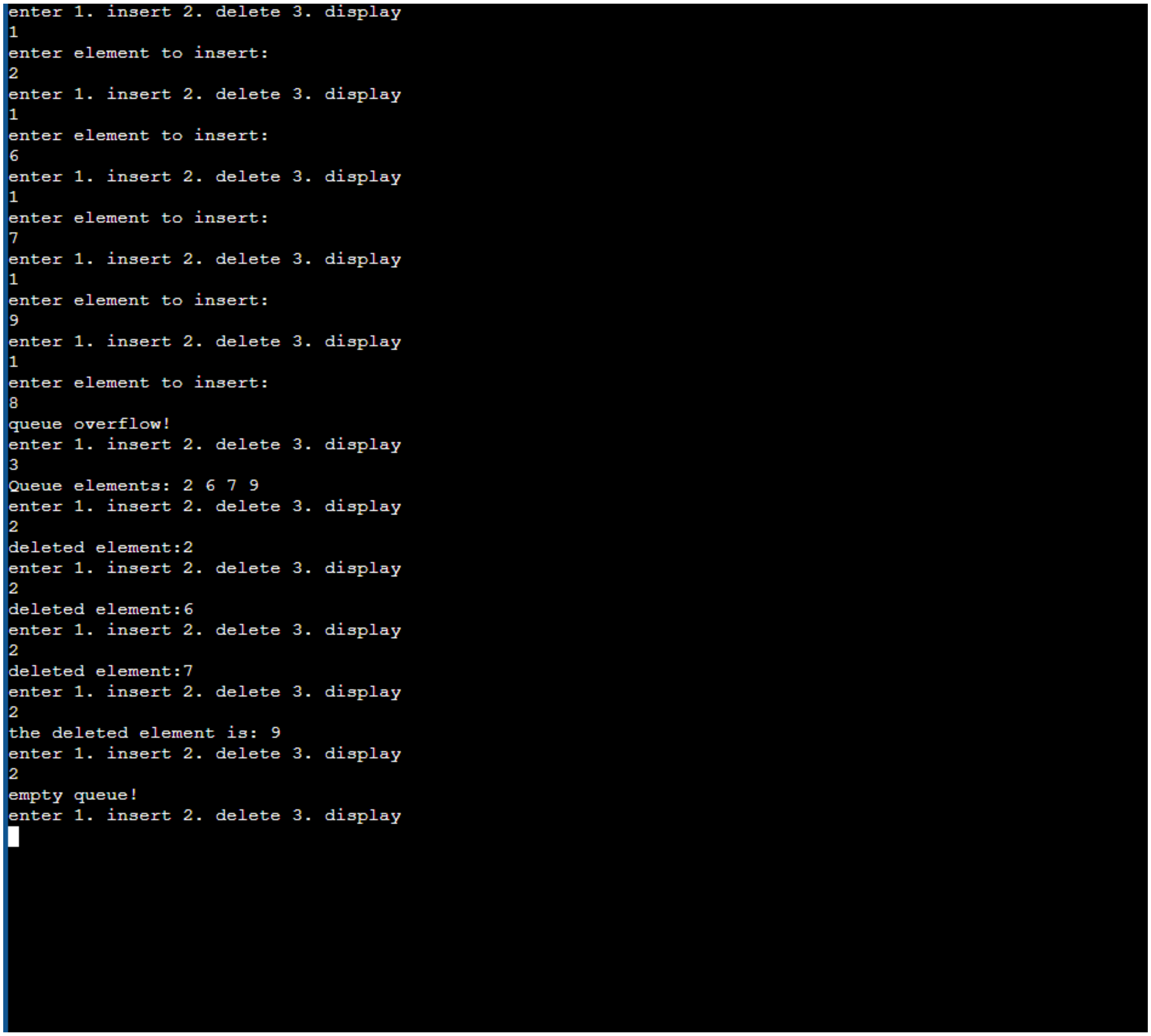
```
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
1
Enter the element to insert:
2
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
1
Enter the element to insert:
4
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
1
Enter the element to insert:
5
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
1
Enter the element to insert:
6
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
1
Overflow!
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
3
6
5
4
2
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
2
Element deleted is 2
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
2
Element deleted is 4
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
2
Element deleted is 5
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
2
Element deleted is 6
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
2
Queue empty!
Enter 1 to add, 2 to delete, 3 to display queue, any other key to exit:
```

b)

```
#include <stdio.h>
#include <stdlib.h>
#define N 4
int q[N];
int REAR=-1;
int FRONT=-1;
void enq();
void deq();
void display();

void enq(){
    int item;
    printf("enter element to insert:\n");
    scanf("%d",&item);
    if(FRONT==-1 && REAR==-1){
        FRONT=REAR=0;
        q[REAR]=item;
    }
    else if((REAR+1)%N==FRONT){
        printf("queue overflow!\n");
    }
    else{
        REAR=(REAR+1)%N;
        q[REAR]=item;
    }
}
void deq(){
    if(FRONT==-1 && REAR==-1){
        printf("empty queue!\n");
    }
    else if(FRONT==REAR){
        printf("the deleted element is: %d\n",q[FRONT]);
        FRONT=REAR=-1;
    }
    else{
        printf("deleted element:%d\n",q[FRONT]);
        FRONT=(FRONT+1)%N;
    }
}
void display(){
    int i;
    if (FRONT == -1 && REAR == -1) {
        printf("Queue is empty\n");
    }
    else {
        printf("Queue elements: ");
        i = FRONT;
        while (i != REAR) {
            printf("%d ", q[i]);
            i = (i + 1) % N;
        }
        printf("%d", q[REAR]); // Print the last element
    }
    printf("\n");
}

void main(){
    int choice;
    while(1){
    printf("enter 1. insert 2. delete 3. display\n");
    scanf("%d",&choice);
    switch(choice){
        case 1: enq();
            break;
        case 2: deq();
           break;
        case 3: display();
           break;
        default: printf("invalid entry\n");
           exit(0);
     }
     }
}
```

OUTPUT:

P.T.O



```
enter 1. insert 2. delete 3. display
1
enter element to insert:
2
enter 1. insert 2. delete 3. display
1
enter element to insert:
6
enter 1. insert 2. delete 3. display
1
enter element to insert:
7
enter 1. insert 2. delete 3. display
1
enter element to insert:
9
enter 1. insert 2. delete 3. display
1
enter element to insert:
8
queue overflow!
enter 1. insert 2. delete 3. display
3
Queue elements: 2 6 7 9
enter 1. insert 2. delete 3. display
2
deleted element:2
enter 1. insert 2. delete 3. display
2
deleted element:6
enter 1. insert 2. delete 3. display
2
deleted element:7
enter 1. insert 2. delete 3. display
2
the deleted element is: 9
enter 1. insert 2. delete 3. display
2
empty queue!
enter 1. insert 2. delete 3. display
```

LAB 4

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. 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;
}
```

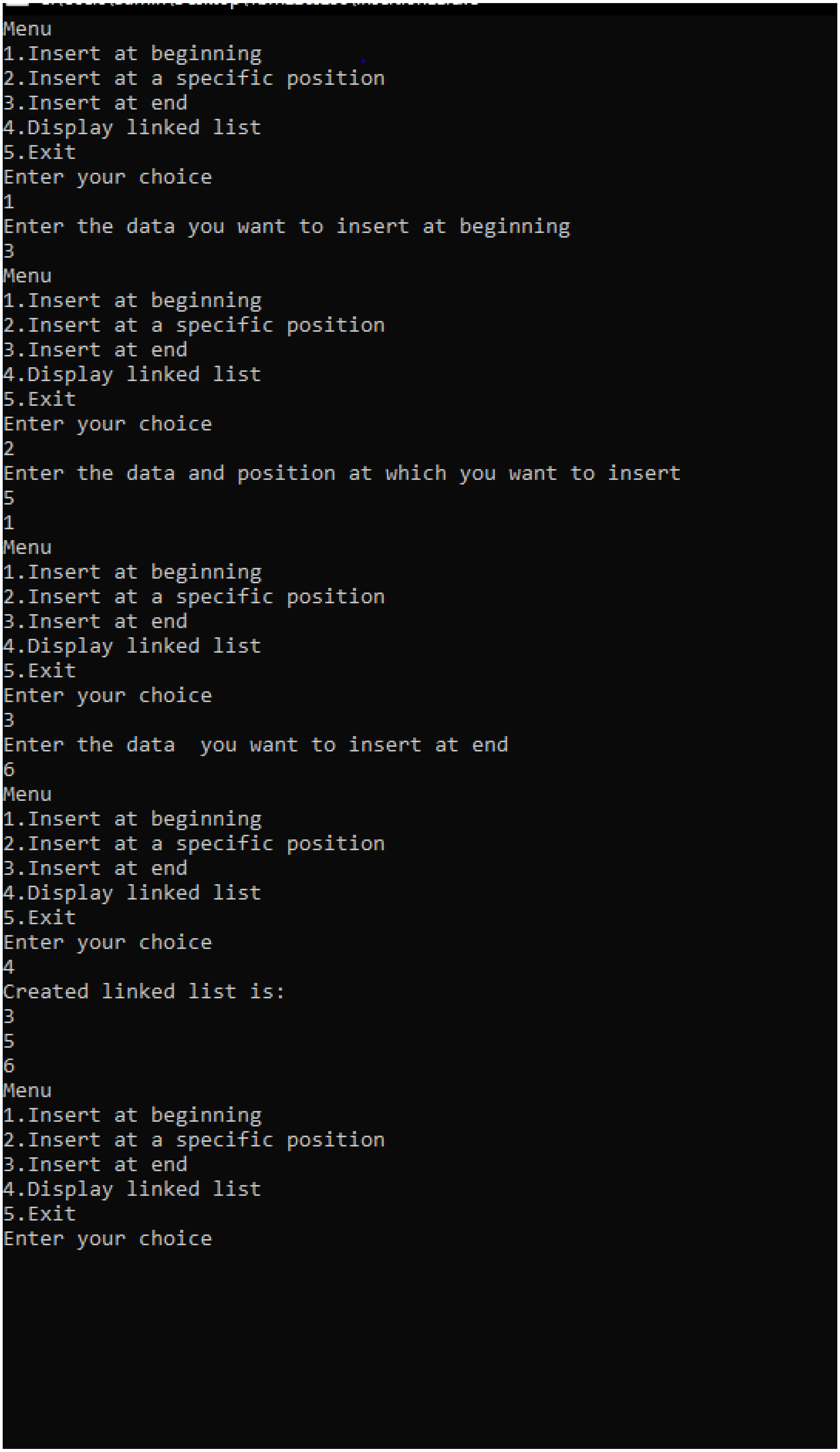
```
void InsertAtEnd(Node **head_ref,int new_data)
{
   Node *new_node=(struct Node*)malloc(sizeof( Node));
   Node *last=*head_ref;
   new_node->data=new_data;
   new_node->next=NULL;
   if (*head_ref==NULL)
   {
      *head_ref=new_node;
      return ;
   }
   while (last->next!=NULL)
      last=last->next;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

}

void Insert(Node **head_ref,int new_data,int pos)
{
   if (*head_ref ==NULL)
   {
      printf("Cannot  be NULL\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;}
```

OUTPUT:

P.T.O



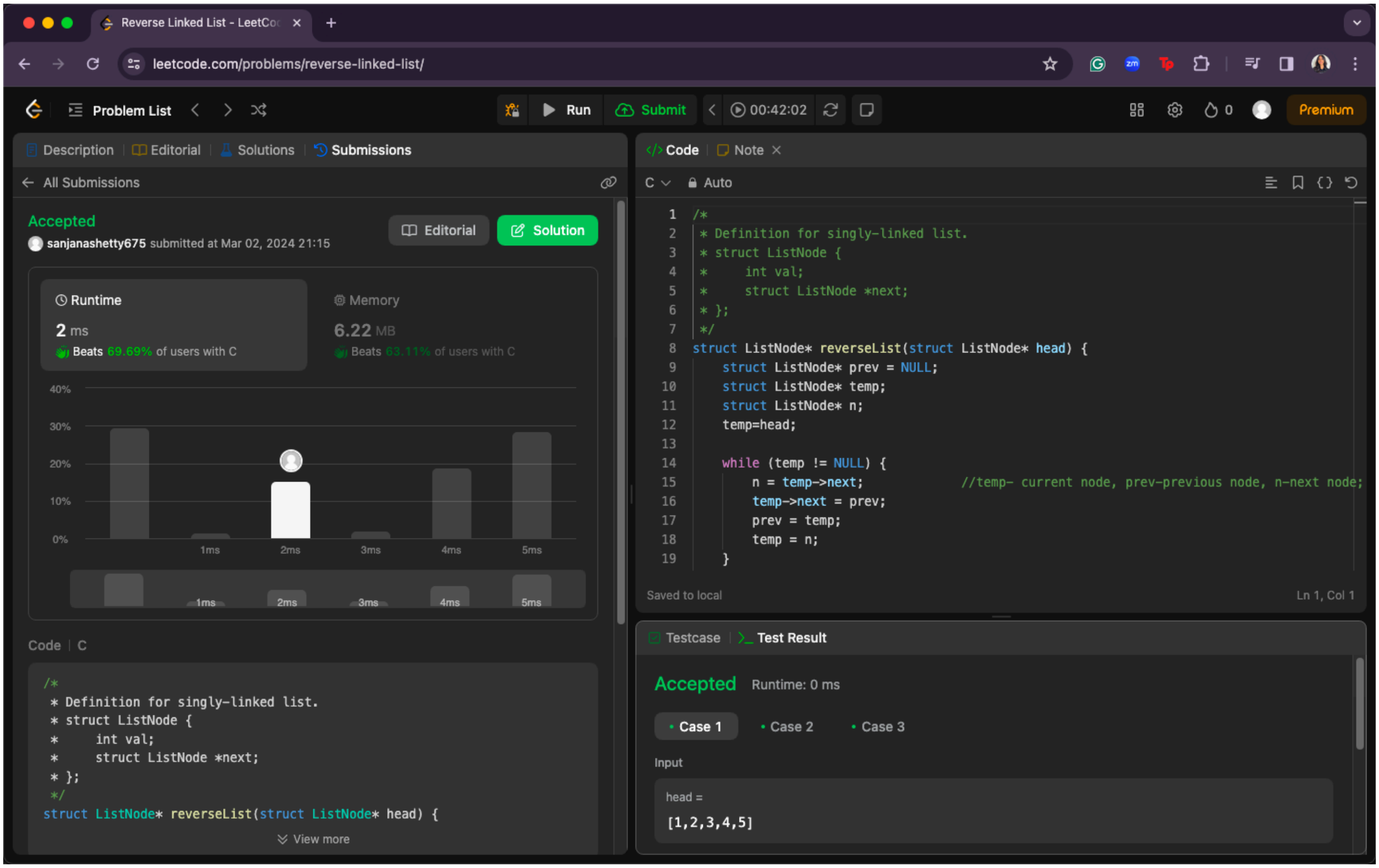
```
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
1
Enter the data you want to insert at beginning
3
Menu
1.Insert at beginning
2.Insert at a specific position
3.Insert at end
4.Display linked list
5.Exit
Enter your choice
2
Enter the data and position at which you want to insert
5
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
3
Enter the data  you want to insert at end
6
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:
3
5
6
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)b) Leetcode Question-Reverse a Singly Linked List

```
/**
 * Definition for singly-linked list.
 * struct ListNode {
 *     int val;
 *     struct ListNode *next;
 * };
 */
struct ListNode* reverseList(struct ListNode* head) {
    struct ListNode* prev = NULL;
    struct ListNode* temp;
    struct ListNode* n;
    temp=head;

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

    return prev;
```

}

OUTPUT:



Accepted

sanjanashetty675 submitted at Mar 02, 2024 21:15

Runtime

2 ms

Beats 69.69% of users with C

Memory

6.22 MB

Beats 63.11% of users with C

Code | C

```c
/*
 * Definition for singly-linked list.
 * struct ListNode {
 *     int val;
 *     struct ListNode *next;
 * };
 */
struct ListNode* reverseList(struct ListNode* head) {
```

```c
/*
 * Definition for singly-linked list.
 * struct ListNode {
 *     int val;
 *     struct ListNode *next;
 * };
 */
struct ListNode* reverseList(struct ListNode* head) {
    struct ListNode* prev = NULL;
    struct ListNode* temp;
    struct ListNode* n;
    temp=head;

    while (temp != NULL) {
        n = temp->next;          //temp- current node, prev-previous node, n-next node;
        temp->next = prev;
        prev = temp;
        temp = n;
    }
```

Saved to local

Ln 1, Col 1

Accepted Runtime: 0 ms

Input

head =

[1,2,3,4,5]

LAB 5

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>


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;
```

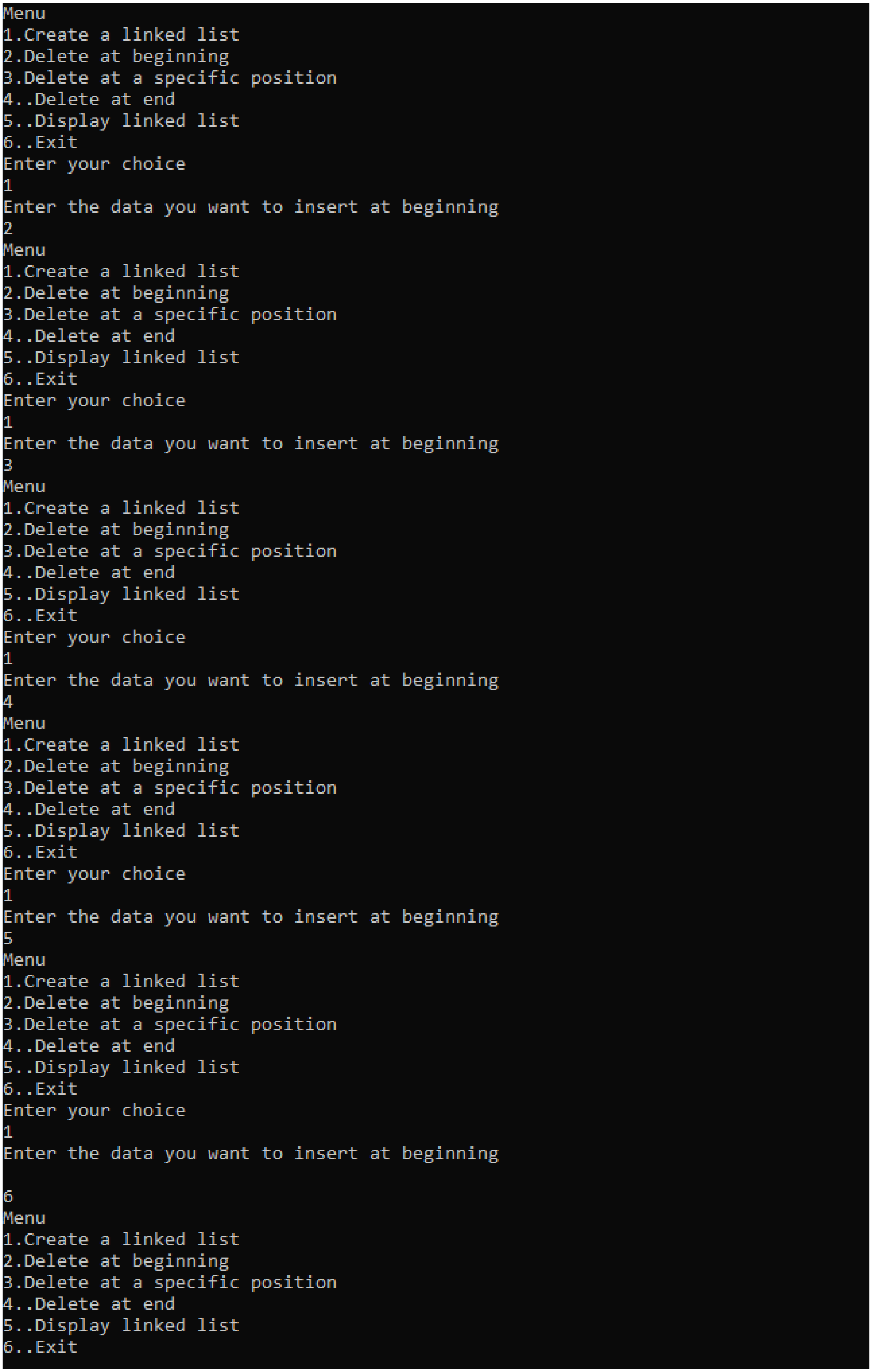
```
if(*head_ref == NULL)

{

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 == 1)
   {
      *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;
```

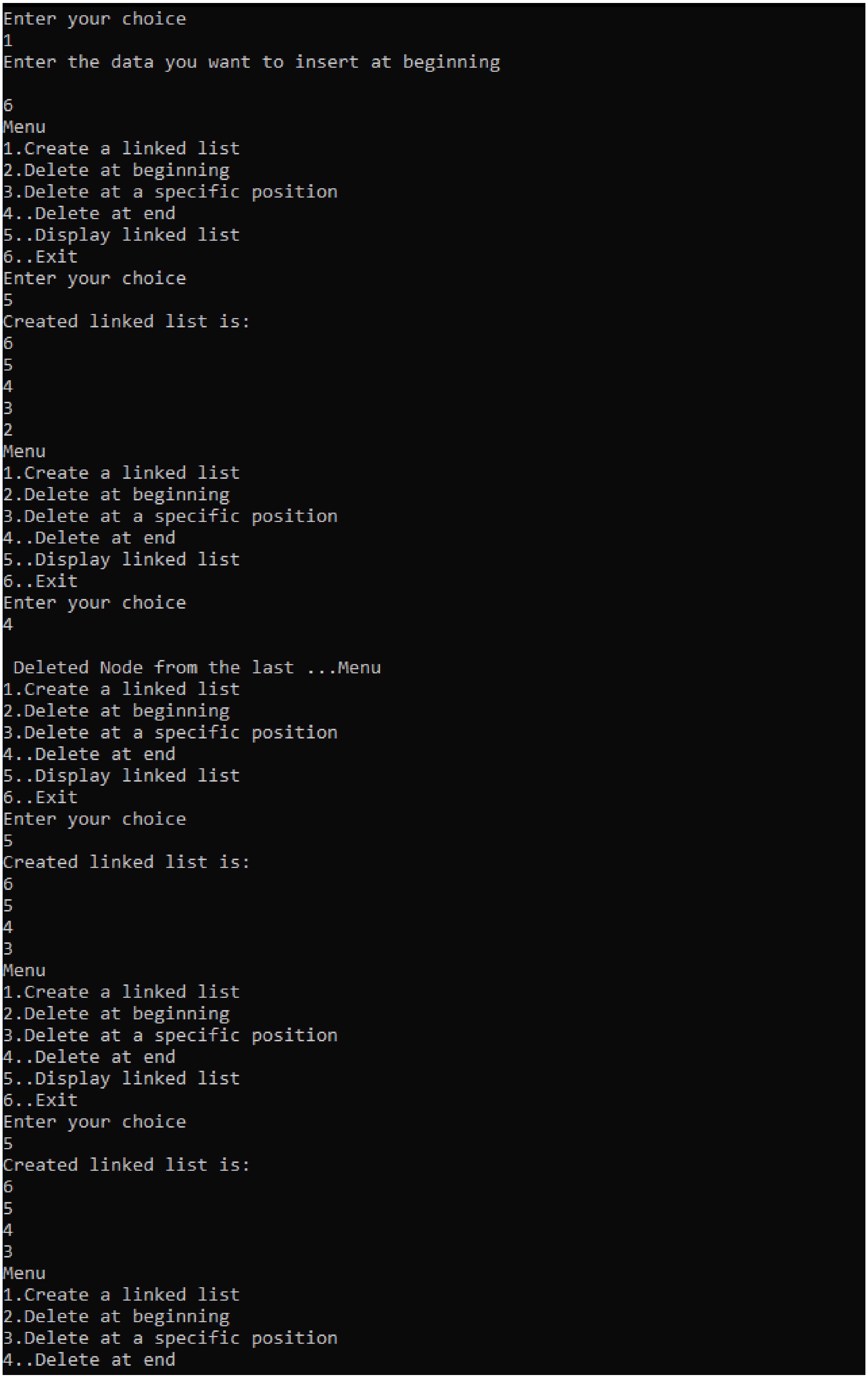
```
while(ch!=6)
{
printf("Menu\n");
printf("1.Create a linked list\n");
printf("2.Delete at beginning\n");
printf("3.Delete at a specific position\n");
printf("4..Delete at end\n");
printf("5..Display linked list\n");
printf("6..Exit\n");
printf("Enter your choice\n");
scanf("%d",&ch);
switch(ch)
{
  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;
}
```

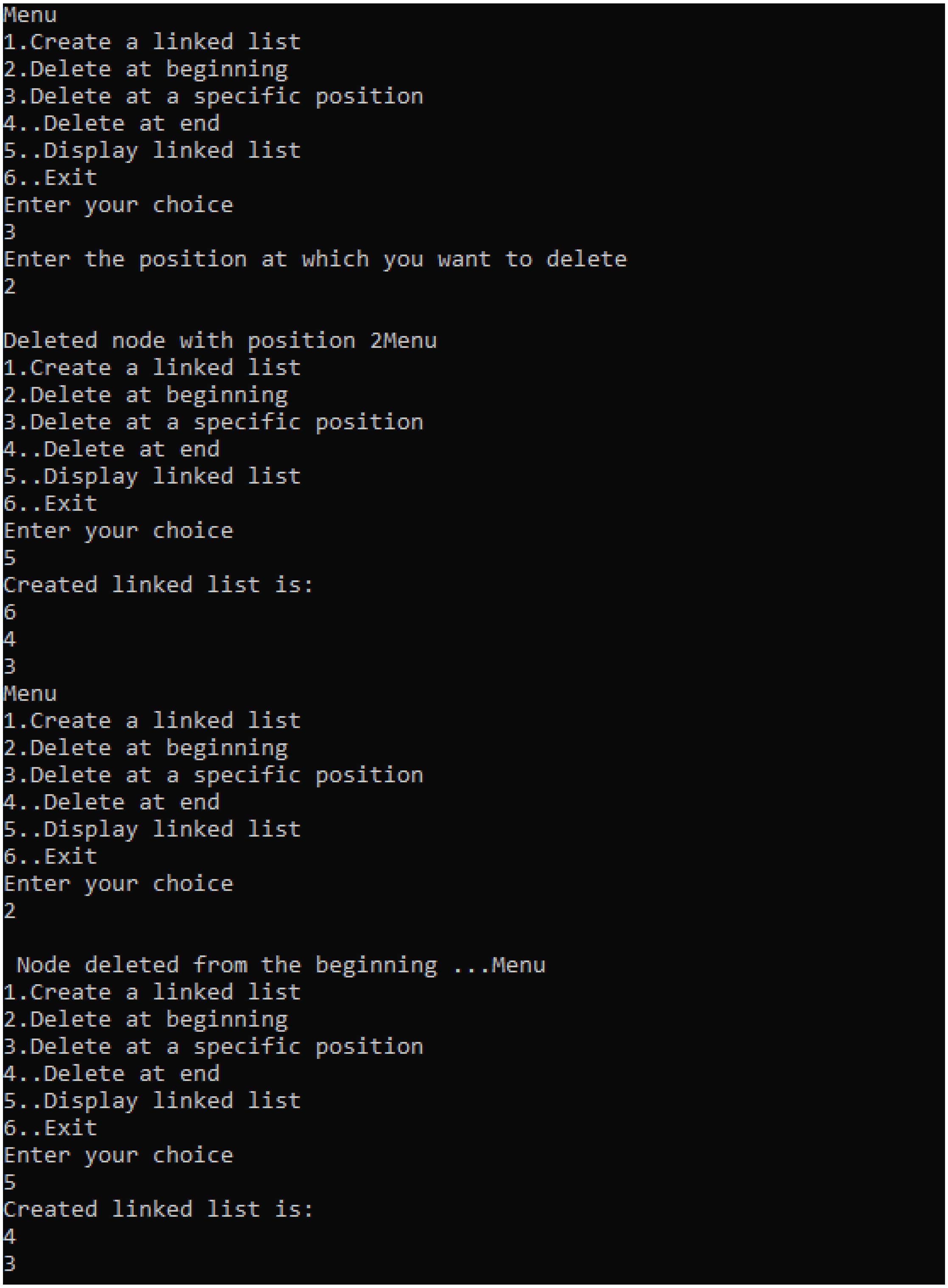
OUTPUT:



```
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
2
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
3
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
4
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
5
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

6
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

6
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:
6
5
4
3
2
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:
6
5
4
3
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:
6
5
4
3
Menu
1.Create a linked list
2.Delete at beginning
3.Delete at a specific position
4..Delete at end
```



```
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
2

Deleted node with position 2Menu
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:
6
4
3
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:
4
3
```

LAB 6

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

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

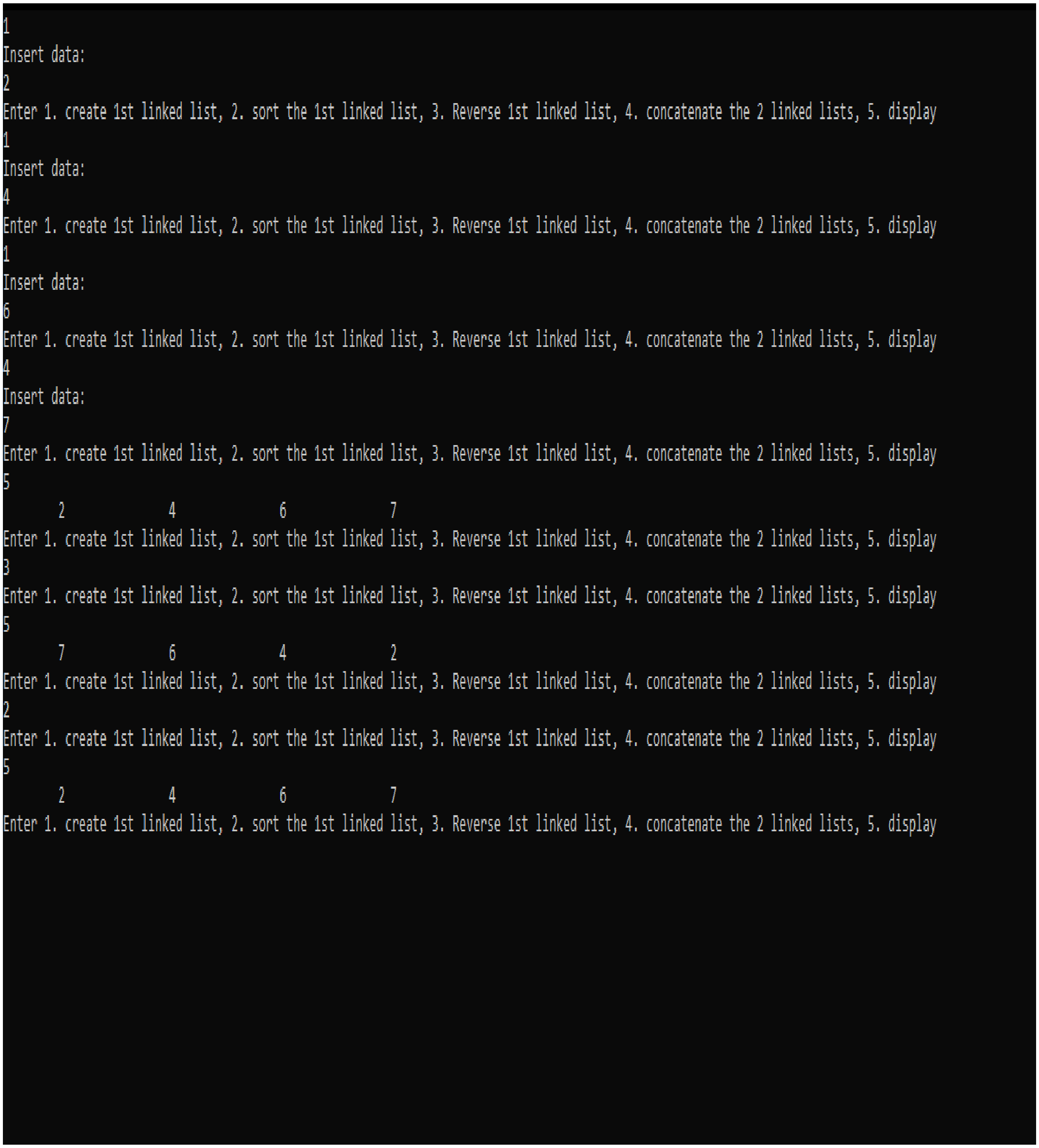
a)

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

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

struct Node *head1, *newnode, *head2, *temp1, *temp2, *prev, *n,
*temp, *current, *index;

void create1() {
   newnode = (struct Node*)malloc(sizeof(struct Node));
   printf("Insert data:\n");
   scanf("%d", &newnode->data);
   if (head1 == NULL) {
      head1 = temp1 = newnode;
```

```
        temp1->next = NULL;
    } else {
        temp1->next = newnode;
        temp1 = newnode;
        temp1->next = NULL;
    }
}

void create2() {
    newnode = (struct Node*)malloc(sizeof(struct Node));
    printf("Insert data:\n");
    scanf("%d", &newnode->data);
    if (head2 == NULL) {
        head2 = temp2 = newnode;
        temp2->next = NULL;
    } else {
        temp2->next = newnode;
        temp2 = newnode;
        temp2->next = NULL;
    }
}

void concat() {
    create2();
    if (head1 == NULL) {
        head1 = head2;
    } else {
        temp1 = head1;
        while (temp1->next != NULL) {
            temp1 = temp1->next;
        }
        temp1->next = head2;
    }
}

void reverse() {
    prev = NULL;
    temp = head1;
    while (temp != NULL) {
        n = temp->next;
        temp->next = prev;
        prev = temp;
        temp = n;
    }
    head1 = prev;
}


void sort() {
    current = head1;
    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;
    }
}

void display() {
    temp1 = head1;
    while (temp1 != NULL) {
        printf("\t%d\t", temp1->data);
        temp1 = temp1->next;
    }
    printf("\n");
}


int main() {
    head1 = NULL;
    head2 = NULL;
    index = NULL;
    while (1) {
        printf("Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display\n");
        int choice;
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                create1();
                break;
            case 2:
                sort();
                break;
            case 3:
```

```
            reverse();
            break;
         case 4:
            concat();
            break;
         case 5:
            display();
            break;
         default:
            exit(1);
      }
   }
   return 0;
}
```

OUTPUT:



```
1
Insert data:
2
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
1
Insert data:
4
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
1
Insert data:
6
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
4
Insert data:
7
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
5
      2           4           6           7
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
3
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
5
      7           6           4           2
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
2
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
5
      2           4           6           7
Enter 1. create 1st linked list, 2. sort the 1st linked list, 3. Reverse 1st linked list, 4. concatenate the 2 linked lists, 5. display
```

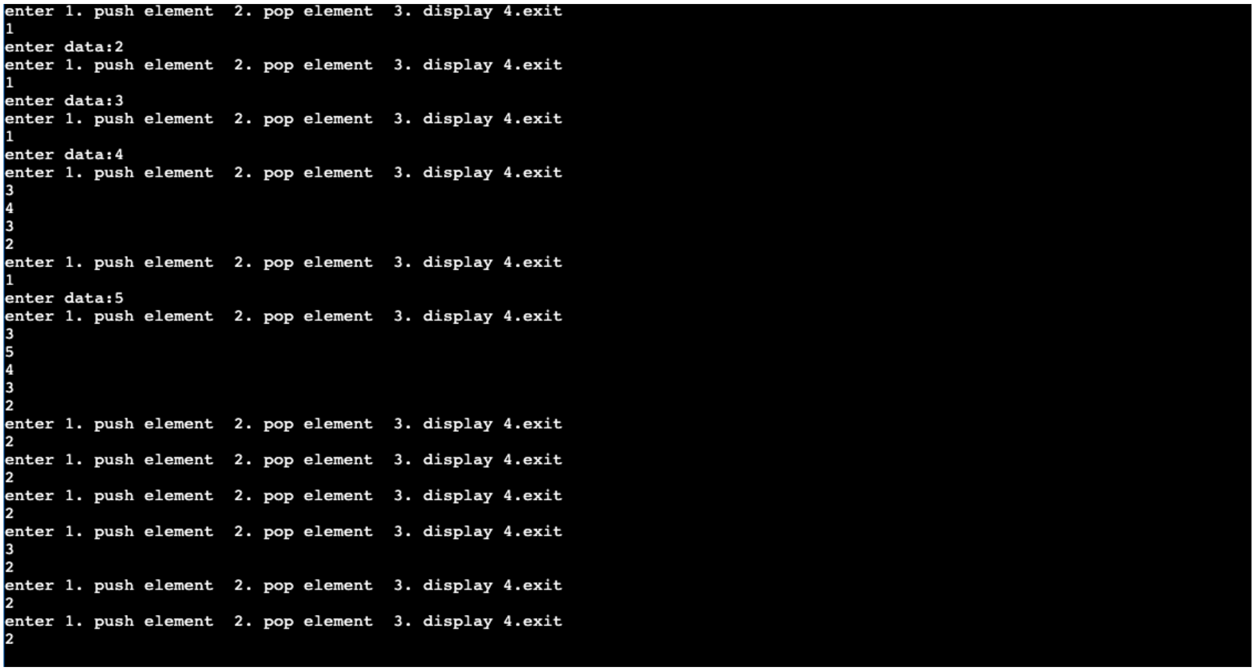
b) STACK

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

struct node{
    int data;
    struct node *next;
};
struct node *head, *temp, *newnode, *p;

void push(){
   newnode=(struct node *)malloc(sizeof(struct node));
   printf("enter data:");
   scanf("%d",&newnode->data);
   if(head==NULL){
        head=temp=newnode;
   }
   else{
        newnode->next=temp;
        head=newnode;
        temp=newnode;
   }
}
void pop(){
    if(head==NULL){
        printf("stack underflow!\n");
    }
    else{
```

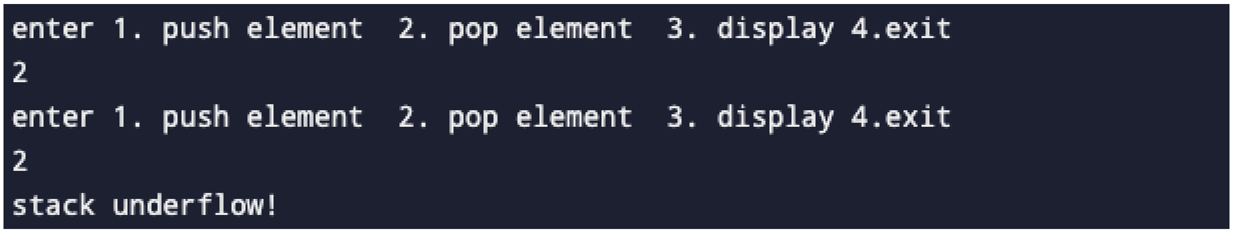
```
   p=head;
   head=head->next;
   p->next=0;
   free(p);
   }
}
void display(){
   temp=head;
   while(temp!=NULL){
      printf("%d\n",temp->data);
      temp=temp->next;
   }
   temp=head=newnode;
}

int main(){
   head=NULL;
   int c;
   while(1){
   printf("enter 1. push element  2. pop element  3. display 4.exit\n");
   scanf("%d",&c);

   switch(c){
      case 1: push();
            break;
      case 2: pop();
            break;
      case 3: display();
            break;
      case 4: exit(1);
   }
```

```
    }
}
```

OUTPUT:



```
enter 1. push element  2. pop element  3. display 4.exit
1
enter data:2
enter 1. push element  2. pop element  3. display 4.exit
1
enter data:3
enter 1. push element  2. pop element  3. display 4.exit
1
enter data:4
enter 1. push element  2. pop element  3. display 4.exit
3
4
3
2
enter 1. push element  2. pop element  3. display 4.exit
1
enter data:5
enter 1. push element  2. pop element  3. display 4.exit
3
5
4
3
2
enter 1. push element  2. pop element  3. display 4.exit
2
enter 1. push element  2. pop element  3. display 4.exit
2
enter 1. push element  2. pop element  3. display 4.exit
2
enter 1. push element  2. pop element  3. display 4.exit
3
2
enter 1. push element  2. pop element  3. display 4.exit
2
enter 1. push element  2. pop element  3. display 4.exit
2
```

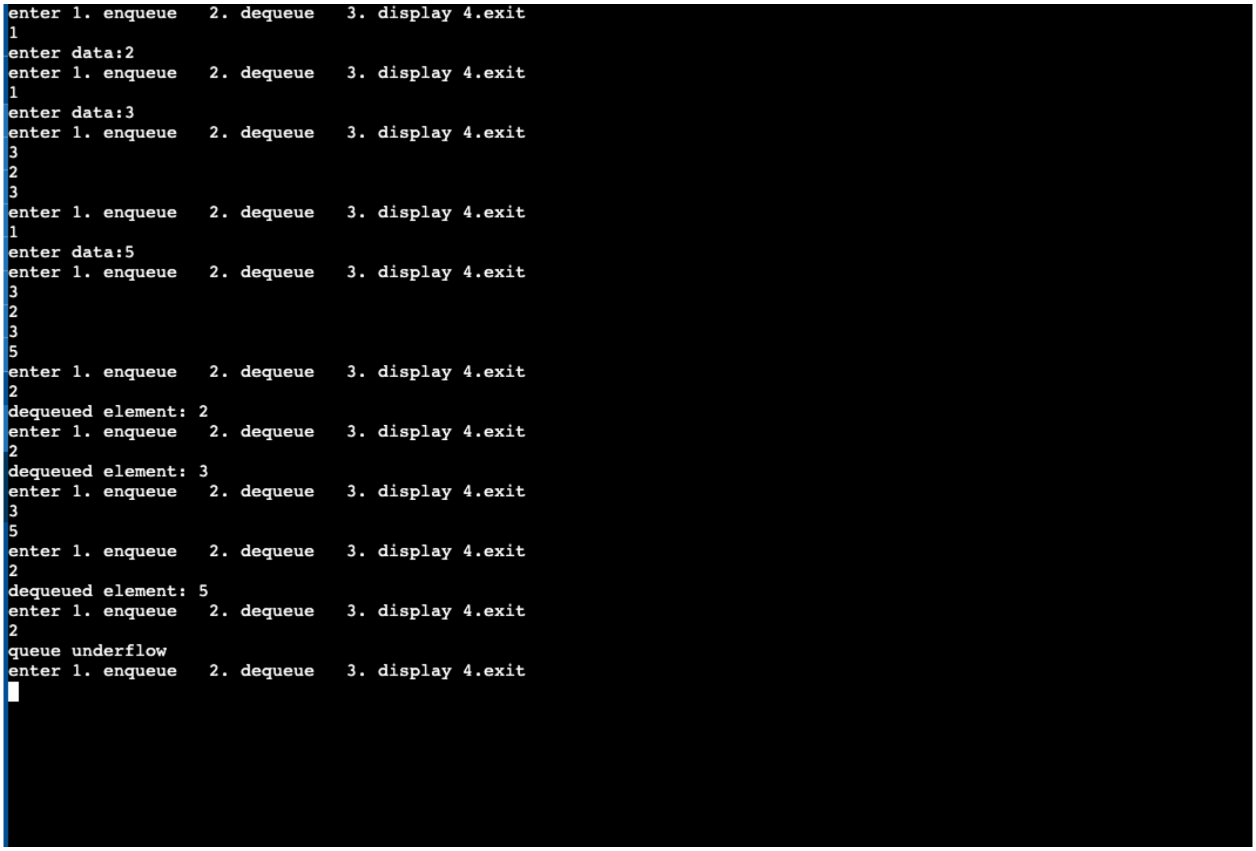


```
enter 1. push element  2. pop element  3. display 4.exit
2
enter 1. push element  2. pop element  3. display 4.exit
2
stack underflow!
```

QUEUE

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

struct node{
    int data;
    struct node *next;
};
struct node *front, *rear, *newnode, *temp, *p;

void enqueue(){
   newnode=(struct node *)malloc(sizeof(struct node));
   printf("enter data:");
   scanf("%d",&newnode->data);
   if(front==NULL && rear==NULL){
       front=rear=newnode;
   }
   else{
       rear->next=newnode;                        //O(1)
       rear=rear->next; //rear=newnode;
   }
}
void dequeue(){ //delete from beginning
    if(front==NULL){
        printf("queue underflow\n");
    }
    else{
    printf("dequeued element: %d\n",front->data);
    p=front;
    front=front->next;
    p->next=NULL;
    free(p);
    }
}
void display(){
    temp=front;           //temp pointer to traverse and display
    if(rear==0 && front==0){
        printf("Queue is empty\n");
    }
    else{
        while(temp!=NULL){
            printf("%d\n",temp->data);
            temp=temp->next;
        }
    }
}

int main(){
    front=NULL;
    rear=NULL;  //tail
    int c;
    while(1){
    printf("enter 1. enqueue   2. dequeue   3. display 4.exit\n");
    scanf("%d",&c);

    switch(c){
        case 1: enqueue();
                break;
        case 2: dequeue();
                break;
        case 3: display();
                break;
        case 4: exit(1);
    }
    }
}
```

OUTPUT:



```
enter 1. enqueue   2. dequeue   3. display 4.exit
1
enter data:2
enter 1. enqueue   2. dequeue   3. display 4.exit
1
enter data:3
enter 1. enqueue   2. dequeue   3. display 4.exit
3
2
3
enter 1. enqueue   2. dequeue   3. display 4.exit
1
enter data:5
enter 1. enqueue   2. dequeue   3. display 4.exit
3
2
3
5
enter 1. enqueue   2. dequeue   3. display 4.exit
2
dequeued element: 2
enter 1. enqueue   2. dequeue   3. display 4.exit
2
dequeued element: 3
enter 1. enqueue   2. dequeue   3. display 4.exit
3
5
enter 1. enqueue   2. dequeue   3. display 4.exit
2
dequeued element: 5
enter 1. enqueue   2. dequeue   3. display 4.exit
2
queue underflow
enter 1. enqueue   2. dequeue   3. display 4.exit
```

LAB 7

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

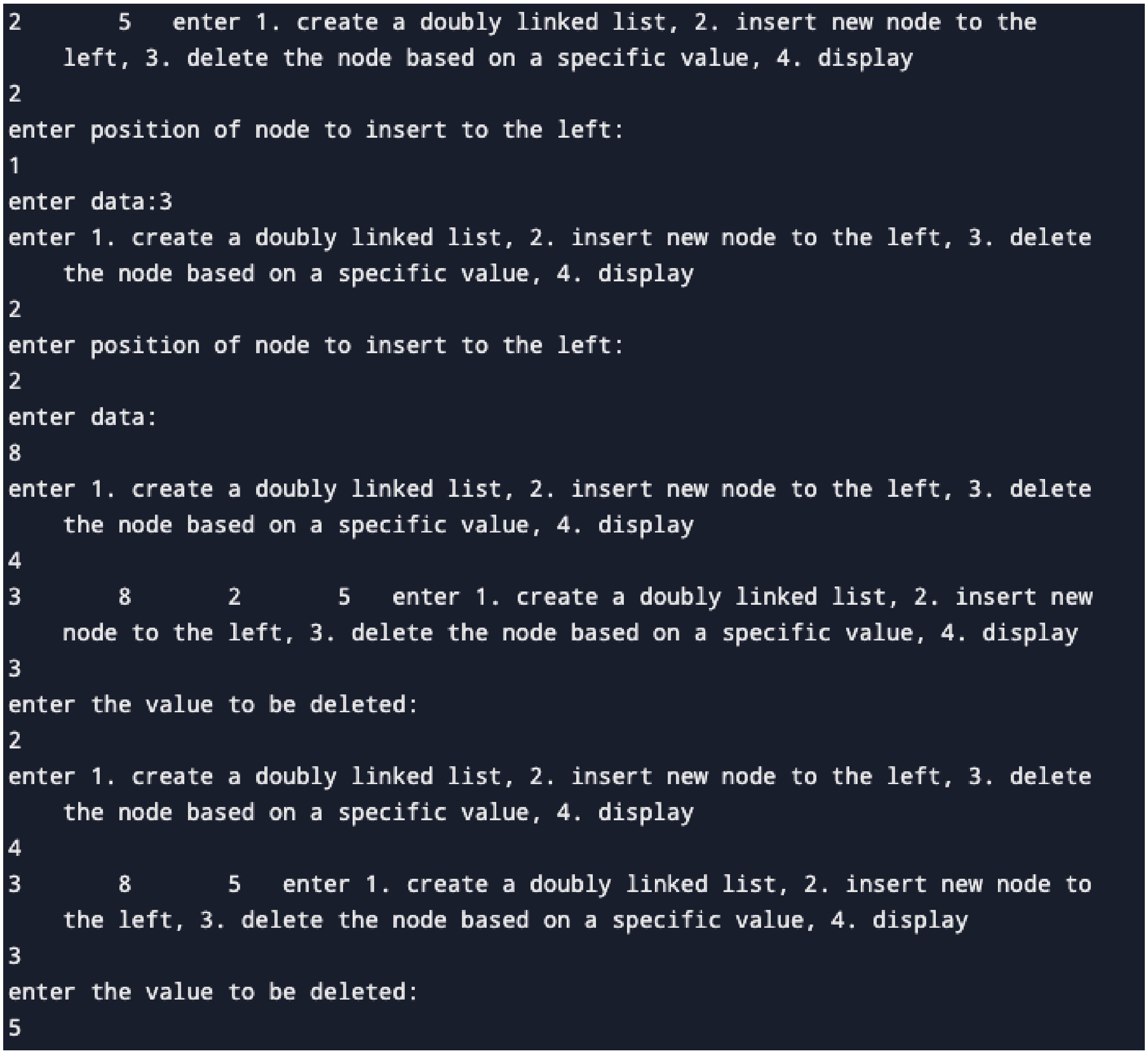
```
#include <stdio.h>
#include <stdlib.h>

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

struct node *head, *temp, *p, *f, *ptr,*newnode;

void create(){
   newnode=(struct node*)malloc(sizeof(struct node));
   printf("enter data:\n");
   scanf("%d",&newnode->data);
   if(head==NULL){
      head=temp=newnode;
      temp->prev=NULL;
```

```
        temp->next=NULL;
    }
    else{
        temp->next=newnode;
        newnode->prev=temp;
        temp=temp->next;
    }
}

void insertLeft(){
    temp=head;
    int pos;
    printf("enter position of node to insert to the left:\n");
    scanf("%d",&pos);
    int i=1;
    if(pos==1){
        newnode=(struct node*)malloc(sizeof(struct node));
        printf("enter data:");
        scanf("%d",&newnode->data);
        newnode->next=temp;
        head=newnode;
        newnode->prev=NULL;
    }
    else{
        while(i<pos){
            p=temp;
            temp=temp->next;
            i++;
        }
        newnode=(struct node*)malloc(sizeof(struct node));
        printf("enter data:\n");
        scanf("%d",&newnode->data);
        newnode->next=temp;
        p->next=newnode;
        newnode->prev=p;
    }
}

void delete(){
    temp=head;
    f=temp;
    int val;
    printf("enter the value to be deleted:\n");
    scanf("%d",&val);
    while(temp!=NULL){
        if(val==temp->data){
            if(temp==head){
                temp=temp->next;
                head=temp;
                f->next=NULL;
                free(f);
            }
            else if(temp->next==NULL){
                f=temp;
                temp->prev=NULL;
                free(f);
            }
            else{
                f->next=temp->next;
                temp->next->prev=f;
                temp->next=NULL;
                temp->prev=NULL;
            ptr=temp;
            free(ptr);
         }
      }
      else{
         f=temp;
         temp=temp->next;
      }
   }
}

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

void main(){
   head=NULL;
   while(1){
      printf("enter 1. create a doubly linked list, 2. insert new node to the left, 3.
delete the node based on a specific value, 4. display\n");

      int choice;
      scanf("%d",&choice);
      switch(choice){
         case 1: create();
               break;
         case 2: insertLeft();
```

```
                break;
            case 3: delete();
                break;
            case 4: display();
                break;
            default: exit(1);
        }
    }
}
```

OUTPUT:

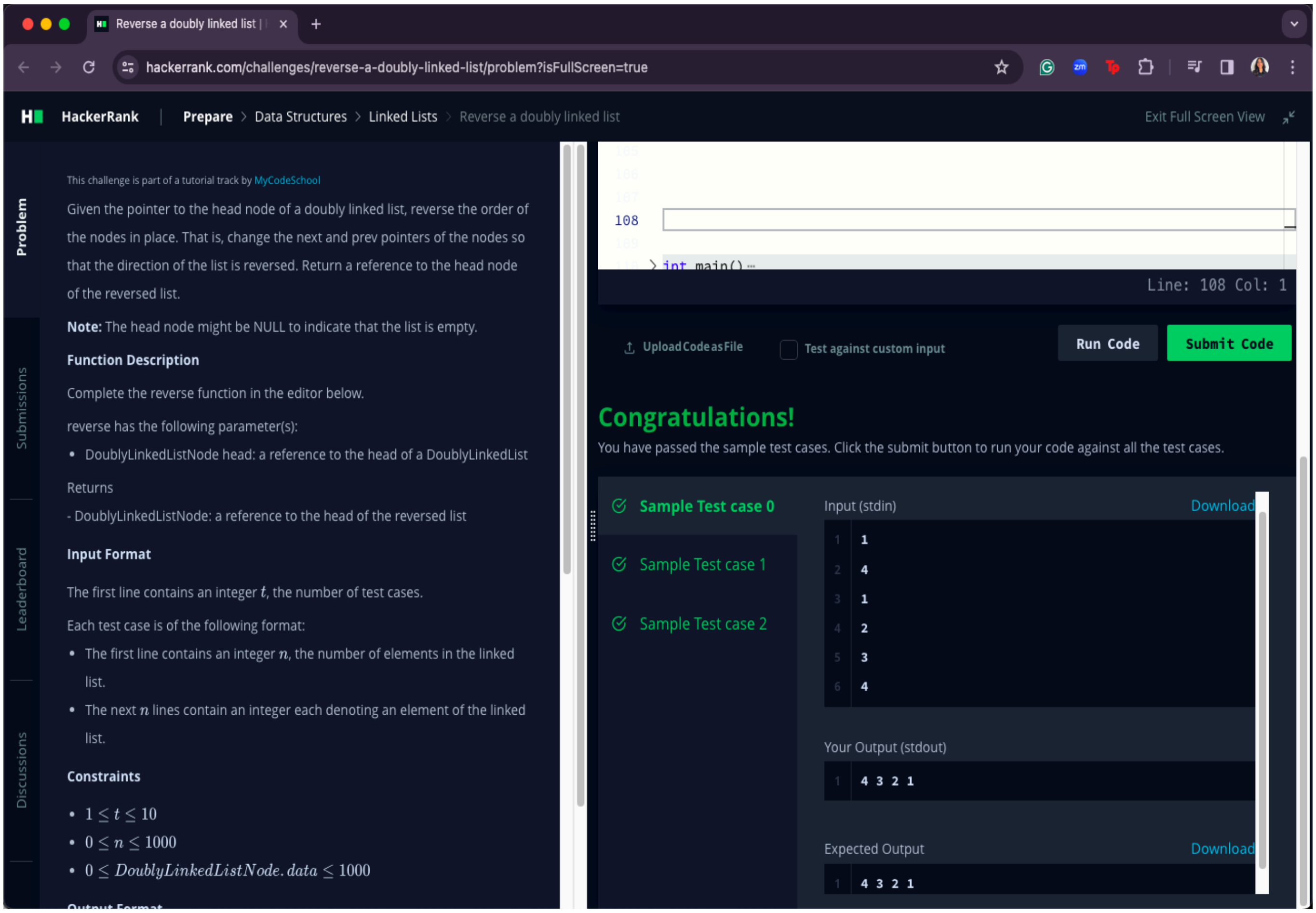
P.T.O



```
2       5   enter 1. create a doubly linked list, 2. insert new node to the
    left, 3. delete the node based on a specific value, 4. display
2
enter position of node to insert to the left:
1
enter data:3
enter 1. create a doubly linked list, 2. insert new node to the left, 3. delete
    the node based on a specific value, 4. display
2
enter position of node to insert to the left:
2
enter data:
8
enter 1. create a doubly linked list, 2. insert new node to the left, 3. delete
    the node based on a specific value, 4. display
4
3       8       2       5   enter 1. create a doubly linked list, 2. insert new
    node to the left, 3. delete the node based on a specific value, 4. display
3
enter the value to be deleted:
2
enter 1. create a doubly linked list, 2. insert new node to the left, 3. delete
    the node based on a specific value, 4. display
4
3       8       5   enter 1. create a doubly linked list, 2. insert new node to
    the left, 3. delete the node based on a specific value, 4. display
3
enter the value to be deleted:
5
```

7) b) Hackerrank Question- Reverse a doubly linked list

```
DoublyLinkedListNode* reverse(DoublyLinkedListNode* llist) {
    DoublyLinkedListNode* temp = llist;
    DoublyLinkedListNode* curr = temp;
    DoublyLinkedListNode* prev = NULL;
    DoublyLinkedListNode* nextOne = NULL;
    while(curr != NULL) {
        nextOne = curr->next;
        curr->next = prev;
        prev = curr;
        curr = nextOne;
    }
    return prev;
}
```


Reverse a doubly linked list |
hackerrank.com/challenges/reverse-a-doubly-linked-list/problem?isFullScreen=true
HackerRank
Prepare > Data Structures > Linked Lists > Reverse a doubly linked list
Exit Full Screen View
Problem
Submissions
Leaderboard
Discussions
Line: 108 Col: 1
Upload Code as File
□ Test against custom input
Run Code
Submit Code
Download
Download

This challenge is part of a tutorial track by MyCodeSchool

Given the pointer to the head node of a doubly linked list, reverse the order of the nodes in place. That is, change the next and prev pointers of the nodes so that the direction of the list is reversed. Return a reference to the head node of the reversed list.

Note: The head node might be NULL to indicate that the list is empty.

Function Description

Complete the reverse function in the editor below.

reverse has the following parameter(s):

- DoublyLinkedListNode head: a reference to the head of a DoublyLinkedList

Returns

- DoublyLinkedListNode: a reference to the head of the reversed list

Input Format

The first line contains an integer t, the number of test cases.

Each test case is of the following format:

- The first line contains an integer n, the number of elements in the linked list.
- The next n lines contain an integer each denoting an element of the linked list.

Constraints

- $1 \leq t \leq 10$
- $0 \leq n \leq 1000$
- $0 \leq DoublyLinkedListNode.data \leq 1000$

Output Format

```
108
int main()…
```

Congratulations!

You have passed the sample test cases. Click the submit button to run your code against all the test cases.

✓ **Sample Test case 0**

✓ Sample Test case 1

✓ Sample Test case 2

Input (stdin)

```
1
4
1
2
3
4
```

Your Output (stdout)

```
4 3 2 1
```

Expected Output

```
4 3 2 1
```

LAB 8

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 post order

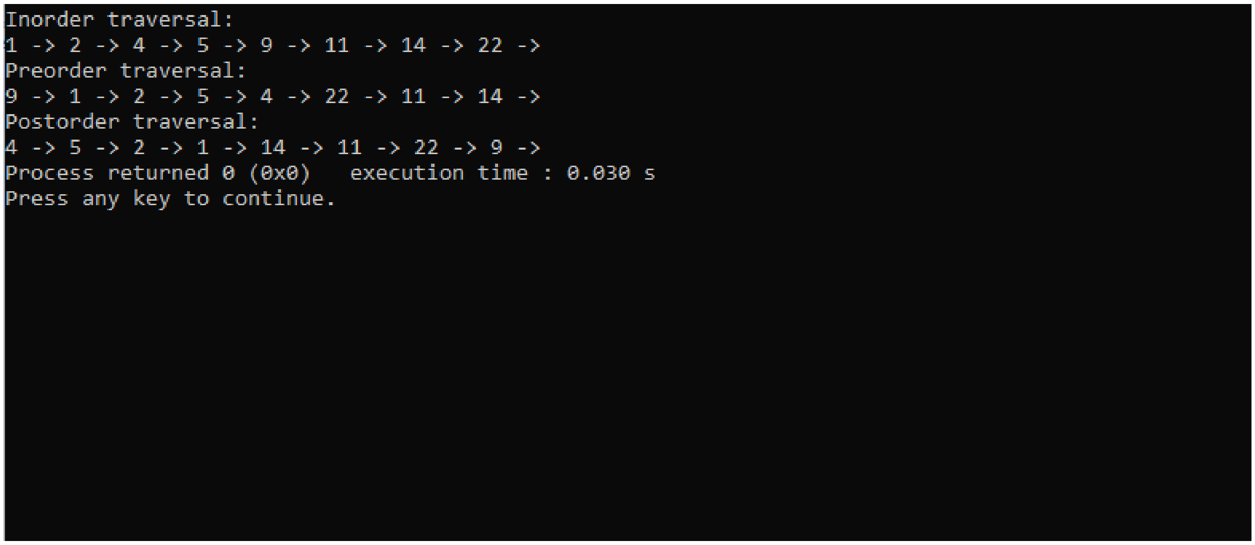
c)To display the elements in the tree.

a)

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

struct node {
  int data;
  struct node *left, *right;
};

// Create a node
struct node *newNode(int item) {
  struct node *temp = (struct node *)malloc(sizeof(struct node));
  temp->data = item;
  temp->left = temp->right = NULL;
  return temp;
```

```
}

// Inorder Traversal
void inorder(struct node *root) {
  if (root != NULL) {
    // Traverse left
    inorder(root->left);

    // Traverse root
    printf("%d -> ", root->data);

    // Traverse right
    inorder(root->right);
  }
}

// Preorder Traversal
void preorder(struct node *root) {
  if (root != NULL) {
    // Traverse root
    printf("%d -> ", root->data);
    // Traverse left
    preorder(root->left);
    // Traverse right
    preorder(root->right);
  }
}

// Postorder Traversal
void postorder(struct node *root) {
  if (root != NULL) {
    // Traverse left
    postorder(root->left);
    // Traverse right
    postorder(root->right);
    // Traverse root
    printf("%d -> ", root->data);
  }
}

// Insert a node
struct node *insert(struct node *node, int data) {
  // Return a new node if the tree is empty
  if (node == NULL) return newNode(data);

  // Traverse to the right place and insert the node
  if (data < node->data)
    node->left = insert(node->left, data);
  else
    node->right = insert(node->right, data);

  return node;
}


// Driver code
int main() {
  struct node *root = NULL;
  root = insert(root, 9);
  root = insert(root, 1);
  root = insert(root, 2);
  root = insert(root, 5);
  root = insert(root, 22);
  root = insert(root, 11);
  root = insert(root, 14);
  root = insert(root, 4);

  printf("\nInorder traversal: \n");
  inorder(root);

  printf("\nPreorder traversal: \n");
  preorder(root);

  printf("\nPostorder traversal: \n");
  postorder(root);

}
```

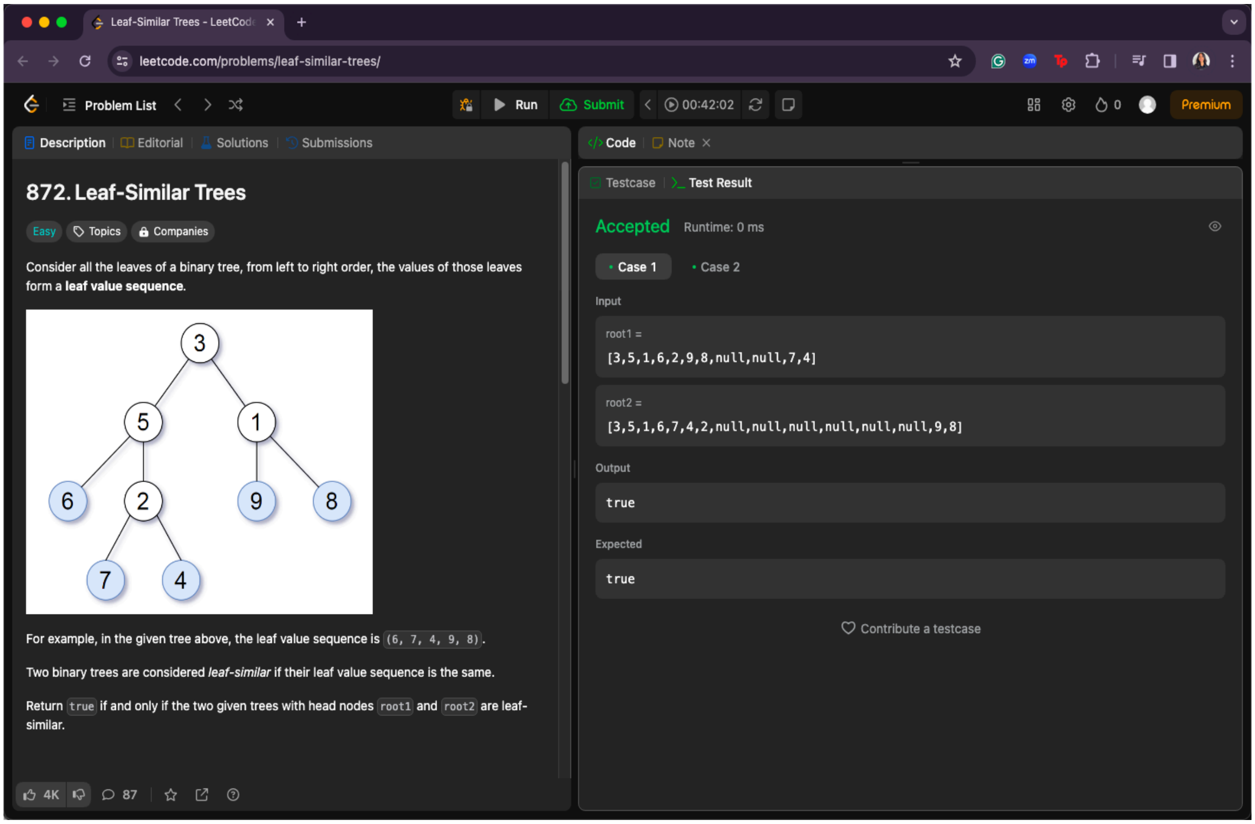
OUTPUT:



```
Inorder traversal:
1 -> 2 -> 4 -> 5 -> 9 -> 11 -> 14 -> 22 ->
Preorder traversal:
9 -> 1 -> 2 -> 5 -> 4 -> 22 -> 11 -> 14 ->
Postorder traversal:
4 -> 5 -> 2 -> 1 -> 14 -> 11 -> 22 -> 9 ->
Process returned 0 (0x0)   execution time : 0.030 s
Press any key to continue.
```

8) b) Leetcode Question - Leaf-Similar Trees

```c
/**
 * Definition for a binary tree node.
 * struct TreeNode {
 *     int val;
 *     struct TreeNode *left;
 *     struct TreeNode *right;
 * };
 */

void findLeaves(struct TreeNode* node, int** leafValues, int* size, int*
capacity) {
    if (node == NULL) {
        return;
    }

    if (node->left == NULL && node->right == NULL) {
        if (*size >= *capacity) {
            *capacity *= 2;
            *leafValues = (int*) realloc(*leafValues, *capacity * sizeof(int));
        }
        (*leafValues)[(*size)++] = node->val;
    }

    findLeaves(node->left, leafValues, size, capacity);
    findLeaves(node->right, leafValues, size, capacity);
}

bool leafSimilar(struct TreeNode* root1, struct TreeNode* root2) {
    int *leaves1 = (int*) malloc(sizeof(int) * 10);
    int size1 = 0, capacity1 = 10;
    int *leaves2 = (int*) malloc(sizeof(int) * 10);
    int size2 = 0, capacity2 = 10;

    findLeaves(root1, &leaves1, &size1, &capacity1);
    findLeaves(root2, &leaves2, &size2, &capacity2);

    if (size1 != size2) {
        free(leaves1);
        free(leaves2);
        return false;
    }

    for (int i = 0; i < size1; i++) {
        if (leaves1[i] != leaves2[i]) {
            free(leaves1);
            free(leaves2);
            return false;
        }
    }

    free(leaves1);
    free(leaves2);
    return true;
}
```



872. Leaf-Similar Trees

Easy Topics Companies

Consider all the leaves of a binary tree, from left to right order, the values of those leaves form a **leaf value sequence.**

For example, in the given tree above, the leaf value sequence is `(6, 7, 4, 9, 8)`.

Two binary trees are considered *leaf-similar* if their leaf value sequence is the same.

Return `true` if and only if the two given trees with head nodes `root1` and `root2` are leaf-similar.

Accepted Runtime: 0 ms

Case 1 Case 2

Input

root1 =

```
[3,5,1,6,2,9,8,null,null,7,4]
```

root2 =

```
[3,5,1,6,7,4,2,null,null,null,null,null,null,9,8]
```

Output

```
true
```

Expected

```
true
```

Contribute a testcase

LAB 9

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

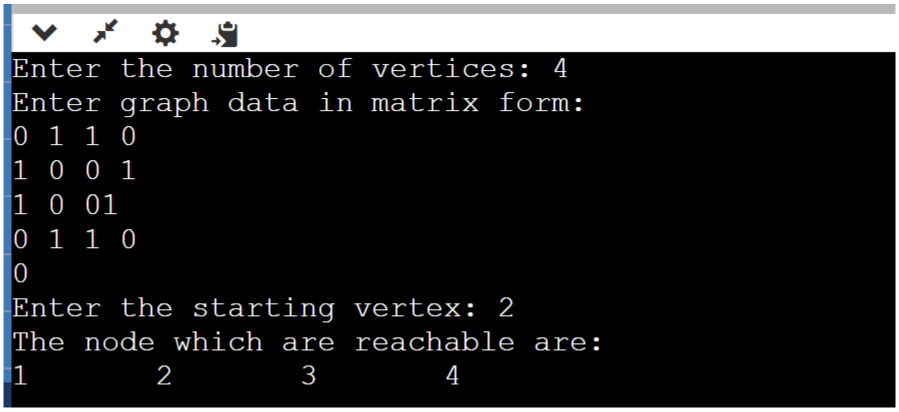
BFS

```
#include <stdio.h>
 int n, i, j, visited[10], queue[10], front = -1, rear = -1;
int adj[10][10];

void bfs(int v)
{
   for (i = 1; i <= n; i++)
      if (adj[v][i] && !visited[i])
         queue[++rear] = i;
   if (front <= rear)
   {
      visited[queue[front]] = 1;
      bfs(queue[front++]);
   }
```

```
}

void main()
{
    int v;
    printf("Enter the number of vertices: ");
    scanf("%d", &n);
    for (i = 1; i <= n; i++)
    {
        queue[i] = 0;
        visited[i] = 0;
    }
    printf("Enter graph data in matrix form:    \n");
    for (i = 1; i <= n; i++)
        for (j = 1; j <= n; j++)
            scanf("%d", &adj[i][j]);
    printf("Enter the starting vertex: ");
    scanf("%d", &v);
    bfs(v);
    printf("The node which are reachable are:    \n");
    for (i = 1; i <= n; i++)
        if (visited[i])
            printf("%d\t", i);
```

```
       else
           printf("BFS is not possible. Not all nodes are reachable");

}
```

OUTPUT:



```
Enter the number of vertices: 4
Enter graph data in matrix form:
0 1 1 0
1 0 0 1
1 0 01
0 1 1 0
0
Enter the starting vertex: 2
The node which are reachable are:
1       2       3       4
```

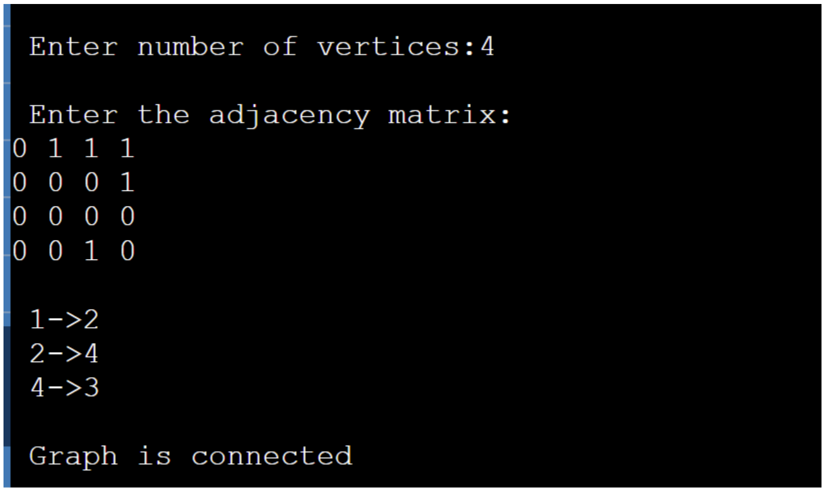
b) DFS

```
#include<stdio.h>

#include<conio.h>

int a[20][20], reach[20], n;

void dfs(int v) {

   int i;
```

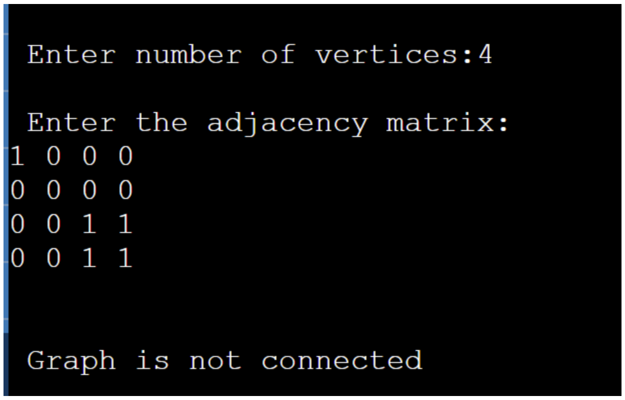
```
    reach[v] = 1;
    for (i = 1; i <= n; i++)
        if (a[v][i] && !reach[i]) {
            printf("\n %d->%d", v, i);
            dfs(i);
        }
}

int main(int argc, char **argv) {
    int i, j, count = 0;
    printf("\n Enter number of vertices:");
    scanf("%d", &n);
    for (i = 1; i <= n; i++) {
        reach[i] = 0;
        for (j = 1; j <= n; j++)
            a[i][j] = 0;
    }
    printf("\n Enter the adjacency matrix:\n");
    for (i = 1; i <= n; i++)
        for (j = 1; j <= n; j++)
            scanf("%d", &a[i][j]);
    dfs(1);
    printf("\n");
```

```
  for (i = 1; i <= n; i++) {
    if (reach[i])
      count++;
  }
  if (count == n)
    printf("\n Graph is connected");
  else
    printf("\n Graph is not connected");
  return 0;
}
```

OUTPUT:



```
 Enter number of vertices:4

 Enter the adjacency matrix:
0 1 1 1
0 0 0 1
0 0 0 0
0 0 1 0

 1->2
 2->4
 4->3

 Graph is connected
```



```
 Enter number of vertices:4

 Enter the adjacency matrix:
1 0 0 0
0 0 0 0
0 0 1 1
0 0 1 1


 Graph is not connected
```