

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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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
COMPUTER SCIENCE AND ENGINEERING



B.M.S. COLLEGE OF ENGINEERING
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This is to certify that the Lab work entitled “**DATA STRUCTURES**” carried out by **VIRAJ PANDURANG SHENVI BELYO(2023BMS02611)** , 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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Course outcomes:

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

Lab program 1:

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

a) Push

b) Pop

c) Display

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

```
#include<stdio.h>
#include<stdlib.h>
#define SIZE 5
int i,stack[SIZE],top=-1;
void main(){
    int value,choice;
    while(1){
        printf("\n1:Push\n2.Pop\n3.Display\n4.Exit\n");
        printf("Enter your choice:");
        scanf("%d",&choice);
        switch(choice)
        {
            case 1:printf("\nEnter the value:");
                    scanf("%d",&value);
                    push(value);
                    break;
            case 2:pop();
                    break;
            case 3:display();
                    break;
            case 4:exit(0);
            default:printf("Invalid input\n");
        }
    }
}

void push(int value){
    if(top==SIZE-1)
        printf("Overflow\n");
    else{
        top=top+1;
        stack[top]=value;
        printf("%d inserted\n",value);}
}

void pop(){
    int value;
    if(top== -1)
        printf("Underflow\n");
    else{
        value=stack[top];
        top=top-1;
        printf("%d removed\n",value); }
}

void display()
```

```

{
    int i;
    if(top==-1)
        printf("Stack is empty");
    else{ printf("The stack elements are:");
        for(i=0;i>=0;i--)
            printf("%d",stack[i]); }
}

```

OUTPUT:

```

C:\Users\tanma\OneDrive\Do
1:Push
2.Pop
3.Display
4.Exit
Enter your choice:1

Enter the value:10
10 inserted

1:Push
2.Pop
3.Display
4.Exit
Enter your choice:1

Enter the value:20
20 inserted

1:Push
2.Pop
3.Display
4.Exit
Enter your choice:2
20 removed

1:Push
2.Pop
3.Display
4.Exit
Enter your choice:3
The stack elements are:10
1:Push
2.Pop
3.Display
4.Exit
Enter your choice:4

Process returned 0 (0x0)   execution time : 24.586 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) and / (divide).

```
#include<stdio.h>

#include<string.h>

int ind=0,top=-1,pos=0,length;

char symbol,temp,infix[20],postfix[20],stack[20];

void infix to postfix();

void push(char symbol);

char pop();

int pred(char symbol);

void main(){

    printf("Enter the infix expression:");

    scanf("%s",infix);

    infixtopostfix();

    printf("\nInfix expression:%s",infix);

    printf("\nPostfix expression:%s",postfix);

}

void infixtopostfix(){

length=strlen(infix);

push('#');

while(ind<length){

    symbol=infix[ind];

    switch(symbol){

        case '(':push (symbol);

        break;

        case ')':temp=pop();

            while (temp !='('){

                postfix[pos]=temp;

                pos++;

                temp=pop(); }

    }
```

```

        break;

    case '+':

    case '-':

    case '*':

    case '/':

        while(pred(stack[top])>=pred(symbol)){

            temp=pop();

            postfix[pos++]=temp; }

        push(symbol);

        break;

    default:postfix[pos++]=symbol; }

ind++;}

while(top >0) {

    temp=pop();

    postfix[pos++]=temp; }}

void push(char symbol){

    top=top+1;

    stack[top]=symbol;}

char pop(){

    char symbol;

    symbol=stack[top];

    top=top-1;

    return (symbol);}

int pred(char symbol){

    int p;

    switch(symbol){

        case '*':

        case '/':p=2;

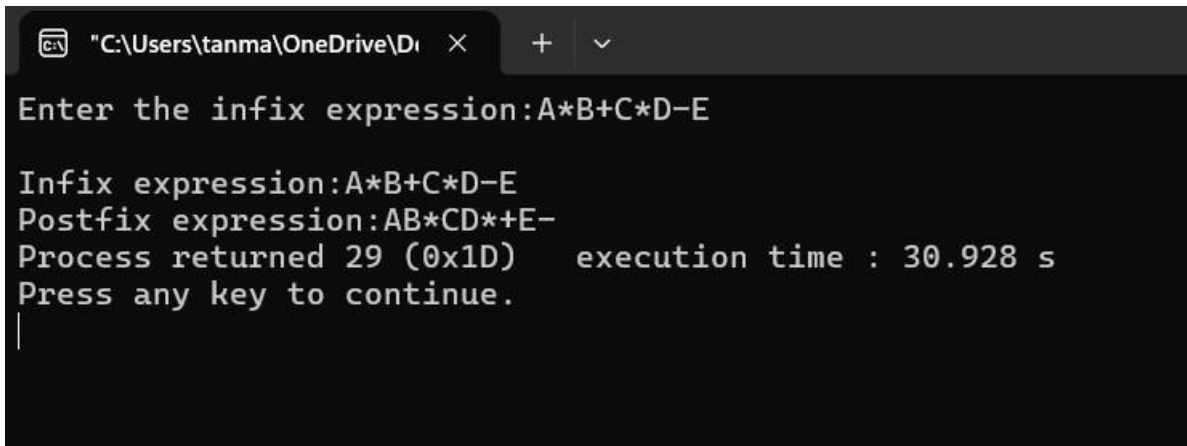
        break;

        case '+':

```

```
case '-':p=1;
break;
case '(':p=0;
break;
case '#':p=-1;
break; }
return(p);}
```

OUTPUT:



```
"C:\Users\tanma\OneDrive\Di" X + v
Enter the infix expression:A*B+C*D-E

Infix expression:A*B+C*D-E
Postfix expression:AB*CD*+E-
Process returned 29 (0x1D)    execution time : 30.928 s
Press any key to continue.
|
```


LAB PROGRAM 3:

a) Write a program to simulate the working of a queue of integers using an array. Provide the following operations: Insert, Delete, Display. The program should print appropriate messages for queue empty and queue overflow conditions.

```
#include <stdio.h>
#include <conio.h>
#define MAX 10
int queue[MAX];
int front = -1, rear = -1;
void insert();
int delete_element();
void display();
int main(){
int option, val;
do{
printf("\n ***** MAIN MENU *****");
printf("\n 1. Insert an element");
printf("\n 2. Delete an element");
printf("\n 3. Display the queue");
printf("\n 4. EXIT");
printf("\n Enter your option :");
scanf("%d", &option);
switch(option) {
    case 1:insert();
        break;
    case 2:val = delete_element();
        if (val != -1)
            printf("\n The number deleted is : %d", val);
        break;
    case 3:display();
        break; }
}while(option != 4);
```

```

getch();

return 0;}

void insert(){
int num;

printf("\n Enter the number to be inserted in the queue : ");
scanf("%d", &num);

if(rear == MAX-1)
printf("\n OVERFLOW");
else if(front == -1 && rear == -1)
front = rear = 0;
else
rear++;

queue[rear] = num;
printf("%d inserted successfully",num);}

int delete_element(){
int val;

if(front == -1 || front>rear){
printf("\n UNDERFLOW");
return -1;}

else{
val = queue[front];
front++;

if(front > rear)
front = rear = -1;
return val;}

}

void display(){
int i;

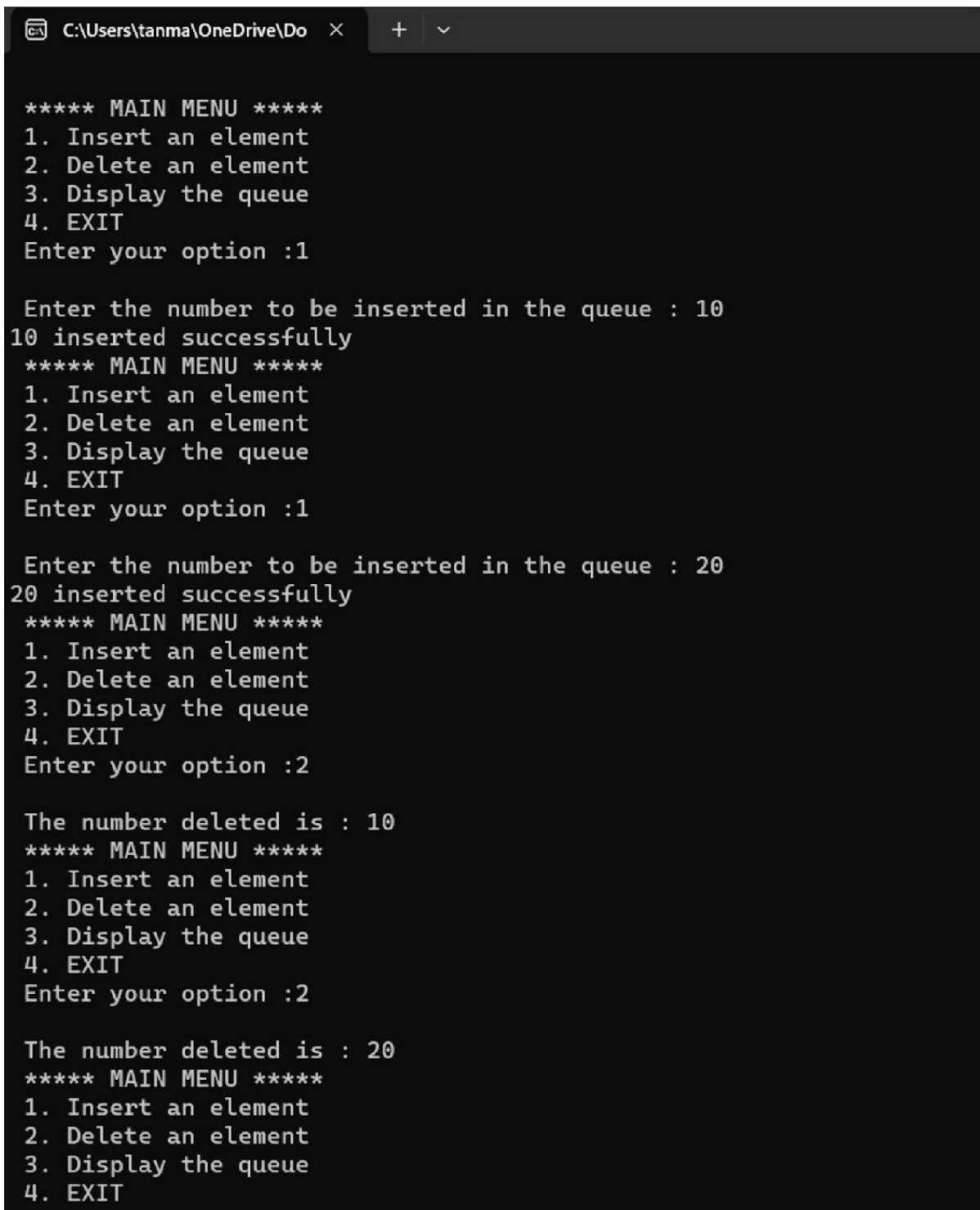
printf("\n");

if(front == -1 || front > rear)
printf("\n QUEUE IS EMPTY");
else{

```

```
for(i = front;i <= rear;i++)  
printf("\t %d", queue[i]);}  
}
```

OUTPUT:



```
***** MAIN MENU *****  
1. Insert an element  
2. Delete an element  
3. Display the queue  
4. EXIT  
Enter your option :1  
  
Enter the number to be inserted in the queue : 10  
10 inserted successfully  
***** MAIN MENU *****  
1. Insert an element  
2. Delete an element  
3. Display the queue  
4. EXIT  
Enter your option :1  
  
Enter the number to be inserted in the queue : 20  
20 inserted successfully  
***** MAIN MENU *****  
1. Insert an element  
2. Delete an element  
3. Display the queue  
4. EXIT  
Enter your option :2  
  
The number deleted is : 10  
***** MAIN MENU *****  
1. Insert an element  
2. Delete an element  
3. Display the queue  
4. EXIT  
Enter your option :2  
  
The number deleted is : 20  
***** MAIN MENU *****  
1. Insert an element  
2. Delete an element  
3. Display the queue  
4. EXIT
```

```
C:\Users\tanma\OneDrive\Do  X + v
4. EXIT
Enter your option :3

QUEUE IS EMPTY
***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
Enter your option :2

UNDERFLOW
***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
Enter your option :1

Enter the number to be inserted in the queue : 10
10 inserted successfully
***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
Enter your option :3

10
***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
Enter your option :4

Process returned 0 (0x0)   execution time : 66.560 s
Press any key to continue.
|
```

b) Write a program 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>

#include <conio.h>

#define MAX 10

int queue[MAX],front=-1,rear=-1;

void insert();

int delete_element();

void display();

int main(){

int option, val;

do{

printf("\n ***** MAIN MENU *****");

printf("\n 1. Insert an element");

printf("\n 2. Delete an element");

printf("\n 3. Display the queue");

printf("\n 4. EXIT");

printf("\n Enter your option : ");

scanf("%d", &option);

switch(option) {

case 1:insert();

break;

case 2:val = delete_element();

if(val!=-1)

printf("\n The number deleted is : %d", val);

break;

case 3:display();

break; }

}while(option!=4);

getch();

return 0;}
```

```

void insert(){
int num;

printf("\n Enter the number to be inserted in the queue : ");
scanf("%d", &num);

if(front==0 && rear==MAX-1)
    printf("\n OVERFLOW");
else if(front== -1 && rear== -1){
front=rear=0;
queue[rear]=num;
printf("Inserted successfully");}
else if(rear==MAX-1 && front!=0){
rear=0;
queue[rear]=num;
printf("Inserted successfully");}
else{
    rear++;
    queue[rear]=num;
    printf("Inserted successfully");} }

int delete_element(){
int val;

if(front== -1 && rear== -1) {
    printf("\n UNDERFLOW");
    return -1; }

val = queue[front];

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

else{
if(front==MAX-1)
front=0;
else
front++;}

return val;

```

```
printf("Deleted successfully.");}

void display(){
int i;
printf("\n");
if (front ==-1 && rear ==-1)
printf ("\n QUEUE IS EMPTY");
else{
printf("The elements of the queue are:");
for(i=front;i!=rear;i=(i+1)%MAX)
printf("\t %d", queue[i]);
printf("\t %d", queue[i]); }
}
```

OUTPUT:

```
"C:\Users\tanma\OneDrive\Dr  ×  +  ~

***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
Enter your option : 1

Enter the number to be inserted in the queue : 10
Inserted successfully
***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
Enter your option : 1

Enter the number to be inserted in the queue : 20
Inserted successfully
***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
Enter your option : 2

The number deleted is : 10
***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
Enter your option : 3

The elements of the queue are:    20
***** MAIN MENU *****
1. Insert an element
2. Delete an element
3. Display the queue
4. EXIT
```


LAB PROGRAM 4:

Write a program 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) Deletion of first element, specified element and last element in the list.**

Display the contents of the linked list.

```
#include <stdio.h>

#include <stdlib.h>

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

struct node *start = NULL;

struct node *insert_beg(struct node *);
struct node *insert_end(struct node *);
struct node *insert_at_pos(struct node *);
struct node *delete_beg(struct node *);
struct node *delete_end(struct node *);
struct node *delete_at_pos(struct node *);
struct node *display(struct node *);

int main(){
    int option;
    do {
        printf("\n\n *****MAIN MENU *****");
        printf("\n 1: Add a node at the beginning");
        printf("\n 2: Add a node at the end");
        printf("\n 3: Add a node at a specific position");
        printf("\n 4: Delete a node from the beginning");
        printf("\n 5: Delete a node from the end");
        printf("\n 6: Delete a node from a specific position");
```

```

printf("\n 7: Display the list");

printf("\n 8: EXIT");

printf("\n\n Enter your option :");

scanf("%d", &option);

switch (option) {

case 1: start = insert_beg(start);

    break;

case 2: start = insert_end(start);

    break;

case 3: start = insert_at_pos(start);

    break;

case 4: start = delete_beg(start);

    break;

case 5: start = delete_end(start);

    break;

case 6: start = delete_at_pos(start);

    break;

case 7: start = display(start);

    break;  }

} while (option != 8);

struct node *temp;

while (start != NULL){

    temp = start;

    start = start->next;

    free(temp); }

return 0;

}

struct node *insert_beg(struct node *start){

    struct node *new_node;

    int num;

    printf("Enter the data: ");

    scanf("%d", &num);

```

```

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

new_node->data = num;

new_node->next = start;

start = new_node;

printf("Inserted at the beginning.\n");

return start;}

struct node *insert_end(struct node *start){

    struct node *ptr, *new_node;

    int num;

    printf("Enter the data: ");

    scanf("%d", &num);

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

    new_node->data = num;

    new_node->next = NULL;

    if (start == NULL) {

        start = new_node;}

    else {

        ptr = start;

        while (ptr->next != NULL)  {

            ptr = ptr->next;    }

        ptr->next = new_node; }

    printf("Inserted at the end.\n");

    return start;}

struct node *insert_at_pos(struct node *start){

    struct node *new_node, *ptr, *preptr;

    int pos, num;

    printf("Enter the position to insert at: ");

    scanf("%d", &pos);

    printf("Enter the data: ");

    scanf("%d", &num);

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

    new_node->data = num;

```

```

new_node->next = NULL;

if (pos == 1) {
    new_node->next = start;
    start = new_node;
    printf("Inserted at position %d.\n", pos);
    return start; }

else {
    int i;

    ptr = start;

    for (int i = 1; i < pos && ptr != NULL; i++) {
        preptr = ptr;
        ptr = ptr->next; }

    if (ptr == NULL && pos > i) {
        printf("Invalid position. Node can't be inserted.\n");
        return start; }

    preptr->next = new_node;
    new_node->next = ptr;
    printf("Inserted at position %d.\n", pos);
    return start' }}

struct node *delete_beg(struct node *start){
    struct node *ptr;

    ptr = start;

    if (ptr == NULL) {
        printf("Empty list. Can't be deleted.\n");
        return start;}

    else {
        start = start->next;
        free(ptr);
        printf("Deleted at the beginning.\n");
        return start; }

}

```

```

struct node *delete_end(struct node *start){

    struct node *ptr, *ptr1;

    ptr = start;

    if (ptr == NULL) {

        printf("Empty list. Can't be deleted.\n");

        return start; }

    else if (ptr->next == NULL){

        free(ptr);

        start = NULL;

        printf("Deleted at the end.\n");

        return start;}

    else{

        while (ptr->next != NULL) {

            ptr1 = ptr;

            ptr = ptr->next;

        }

        ptr1->next = NULL;

        free(ptr);

        printf("Deleted at the end.\n");

        return start; }

}

struct node *delete_at_pos(struct node *start){

    struct node *ptr, *preptr;

    int pos;

    printf("Enter the position to delete: ");

    scanf("%d", &pos);

    if (start == NULL) {

        printf("Empty list. Can't be deleted.\n");

        return start; }

    ptr = start;

    if (pos == 1) {

        start = start->next;

```

```

    free(ptr);

    printf("Deleted at position %d.\n", pos);

    return start; }

else {

    for (int i = 1; i < pos && ptr != NULL; i++){

        preptr = ptr;

        ptr = ptr->next; }

    if (ptr == NULL) {

        printf("Invalid position. Node can't be deleted.\n");

        return start;}

    preptr->next = ptr->next;

    free(ptr);

    printf("Deleted at position %d.\n", pos);

    return start; }}

struct node *display(struct node *start){

    struct node *ptr;

    ptr = start;

    if (ptr == NULL){

        printf("Empty list.\n");

        return start;}

    else{

        printf("Linked list elements: ");

        while (ptr != NULL){

            printf("%d\t", ptr->data);

            ptr = ptr->next;}

        printf("\n");

        return start;} }

```

OUTPUT:

```
C:\Users\tanma\OneDrive\Do  ×  +  v

*****MAIN MENU *****
1: Add a node at the beginning
2: Add a node at the end
3: Add a node at a specific position
4: Delete a node from the beginning
5: Delete a node from the end
6: Delete a node from a specific position
7: Display the list
8: EXIT

Enter your option :1
Enter the data: 10
Inserted at the beginning.

*****MAIN MENU *****
1: Add a node at the beginning
2: Add a node at the end
3: Add a node at a specific position
4: Delete a node from the beginning
5: Delete a node from the end
6: Delete a node from a specific position
7: Display the list
8: EXIT

Enter your option :2
Enter the data: 30
Inserted at the end.

*****MAIN MENU *****
1: Add a node at the beginning
2: Add a node at the end
3: Add a node at a specific position
4: Delete a node from the beginning
5: Delete a node from the end
6: Delete a node from a specific position
7: Display the list
```

7: Display the list
8: EXIT

Enter your option :3
Enter the position to insert at: 2
Enter the data: 20
Inserted at position 2.

*****MAIN MENU *****

1: Add a node at the beginning
2: Add a node at the end
3: Add a node at a specific position
4: Delete a node from the beginning
5: Delete a node from the end
6: Delete a node from a specific position
7: Display the list
8: EXIT

Enter your option :7
Linked list elements: 10 20 30

*****MAIN MENU *****

1: Add a node at the beginning
2: Add a node at the end
3: Add a node at a specific position
4: Delete a node from the beginning
5: Delete a node from the end
6: Delete a node from a specific position
7: Display the list
8: EXIT

Enter your option :4
Deleted at the beginning.

*****MAIN MENU *****

1: Add a node at the beginning
2: Add a node at the end


```
2: Add a node at the end
3: Add a node at a specific position
4: Delete a node from the beginning
5: Delete a node from the end
6: Delete a node from a specific position
7: Display the list
8: EXIT
```

```
Enter your option :6
Enter the position to delete: 2
Deleted at position 2.
```

```
*****MAIN MENU *****
```

```
1: Add a node at the beginning
2: Add a node at the end
3: Add a node at a specific position
4: Delete a node from the beginning
5: Delete a node from the end
6: Delete a node from a specific position
7: Display the list
8: EXIT
```

```
Enter your option :7
Linked list elements: 20
```

```
*****MAIN MENU *****
```

```
1: Add a node at the beginning
2: Add a node at the end
3: Add a node at a specific position
4: Delete a node from the beginning
5: Delete a node from the end
6: Delete a node from a specific position
7: Display the list
8: EXIT
```

```
Enter your option :8
```

```
Process returned 0 (0x0)    execution time : 67.518 s
```

LAB PROGRAM 5:

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

```
#include <stdio.h>

#include <stdlib.h>

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

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

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

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

```

        nextNode->data = temp; }

        nextNode = nextNode->next;}

    current = current->next;}
}

void reverseList(struct Node** head) {
    struct Node *prev, *current, *nextNode;

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

        current->next = prev;

        prev = current;
        current = nextNode; }
    *head = prev;}

void concatenateLists(struct Node** list1, struct Node* list2) {
    if (*list1 == NULL) {
        *list1 = list2;

        return; }

    struct Node* temp = *list1;
    while (temp->next != NULL) {
        temp = temp->next; }
    temp->next = list2;}

void main() {
    struct Node* list1 = NULL;
    struct Node* list2 = NULL;

    int choice;
    int data;

    while(1) {
        printf("\n1. Insert into List 1\n");
        printf("2. Insert into List 2\n");
        printf("3. Sort List 1\n");

```

```

printf("4. Reverse List 2\n");
printf("5. Concatenate Lists\n");
printf("6. Print Lists\n");
printf("7. Exit\n");
printf("Enter your choice: ");
scanf("%d", &choice);
switch (choice) {
    case 1: printf("Enter data to insert into List 1: ");
        scanf("%d", &data);
        insertAtBeginning(&list1, data);
        break;
    case 2: printf("Enter data to insert into List 2: ");
        scanf("%d", &data);
        insertAtBeginning(&list2, data);
        break;
    case 3: sortList(&list1);
        printf("List 1 sorted.\n");
        break;
    case 4: reverseList(&list1);
        printf("List 1 reversed.\n");
        break;
    case 5: concatenateLists(&list1, list2);
        printf("Lists concatenated.\n");
        break;
    case 6:
        printf("List 1: ");
        printList(list1);
        printf("List 2: ");
        printList(list2);
        break;
    case 7:

```

```

        exit(0);

        break;

default:

    printf("Invalid choice\n");

    }

    }

}

```

OUTPUT:

```

C:\Users\tanma\OneDrive\Di >
1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 1
Enter data to insert into List 1: 10

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 1
Enter data to insert into List 1: 12

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 6
List 1: 12 10
List 2:

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 3

```

```
"C:\Users\tanma\OneDrive\Di X + v
Enter your choice: 3
List 1 sorted.

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 6
List 1: 10 12
List 2:

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 4
List 1 reversed.

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 6
List 1: 12 10
List 2:

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
```



"C:\Users\tanma\OneDrive\Dr



```
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 2
Enter data to insert into List 2: 30

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 6
List 1: 12 10
List 2: 30

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 5
Lists concatenated.

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 6
List 1: 12 10 30
List 2: 30

1. Insert into List 1
2. Insert into List 2
```

```
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 2
Enter data to insert into List 2: 30
```

```
1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
```

```
Enter your choice: 6
List 1: 12 10
List 2: 30
```

```
1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
```

```
Enter your choice: 5
Lists concatenated.
```

```
1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
```

```
Enter your choice: 6
List 1: 12 10 30
List 2: 30
```

```
1. Insert into List 1
2. Insert into List 2
```



```
"C:\Users\tanma\OneDrive\Di  X + v
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 5
Lists concatenated.

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 6
List 1: 12 10 30
List 2: 30

1. Insert into List 1
2. Insert into List 2
3. Sort List 1
4. Reverse List 2
5. Concatenate Lists
6. Print Lists
7. Exit
Enter your choice: 7

Process returned 0 (0x0)    execution time : 69.851 s
Press any key to continue.
|
```

LAB PROGRAM 6:

Write a program to Implement Single Link List to simulate Stack & Queue Operations.

```
#include <stdio.h>

#include <stdlib.h>

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

struct stack *top = NULL;

struct stack *push(struct stack *, int);
struct stack *display(struct stack *);
struct stack *pop(struct stack *);

void main(){
int val, option;
while(1){
printf("\n *****MAIN MENU*****");
printf("\n 1. PUSH");
printf("\n 2. POP");
printf("\n 3. DISPLAY");
printf("\n 4. EXIT");
printf("\n Enter your option: ");
scanf("%d", &option);
switch(option){
case 1:
printf("\n Enter the number to be pushed on stack: ");
scanf("%d", &val);
top = push(top, val);
break;
case 2:
top = pop(top);
```

```

break;

case 3:

top = display(top);

break;

case 4:exit(0);

default:printf("Invalid input"); } }

}

struct stack *push(struct stack *top, int val){

struct stack *ptr;

ptr = (struct stack*)malloc(sizeof(struct stack));

ptr -> data = val;

if(top == NULL){

ptr -> next = NULL;

top = ptr;

printf("The value %d is inserted",val);}

else{

ptr -> next = top;

top = ptr;

printf("The value %d is inserted",val);}

return top;}

struct stack *display(struct stack *top){

struct stack *ptr;

ptr = top;

if(top == NULL)

printf("\n STACK IS EMPTY");

else{

printf("The stack elements are:");

while(ptr != NULL) {

printf("\n %d", ptr -> data);

ptr = ptr -> next; } }

return top;}

struct stack *pop(struct stack *top){

```

```

struct stack *ptr;

ptr = top;

if(top == NULL)

printf("\n STACK UNDERFLOW");

else{

top = top -> next;

printf("\n The value being deleted is: %d", ptr -> data);

free(ptr);}

return top;}

```

OUTPUT:

```

*****MAIN MENU*****
1. PUSH
2. POP
3. DISPLAY
4. EXIT
Enter your option: 1

Enter the number to be pushed on stack: 10
The value 10 is inserted
*****MAIN MENU*****
1. PUSH
2. POP
3. DISPLAY
4. EXIT
Enter your option: 1

Enter the number to be pushed on stack: 20
The value 20 is inserted
*****MAIN MENU*****
1. PUSH
2. POP
3. DISPLAY
4. EXIT
Enter your option: 3
The stack elements are:
20
10
*****MAIN MENU*****
1. PUSH
2. POP
3. DISPLAY
4. EXIT
Enter your option: 2

The value being deleted is: 20
*****MAIN MENU*****
1. PUSH
2. POP
3. DISPLAY

```

```
"C:\Users\tanma\OneDrive\Di  X + v

Enter your option: 3
The stack elements are:
20
10
*****MAIN MENU*****
1. PUSH
2. POP
3. DISPLAY
4. EXIT
Enter your option: 2

The value being deleted is: 20
*****MAIN MENU*****
1. PUSH
2. POP
3. DISPLAY
4. EXIT
Enter your option: 3
The stack elements are:
10
*****MAIN MENU*****
1. PUSH
2. POP
3. DISPLAY
4. EXIT
Enter your option: 4

Process returned 0 (0x0)    execution time : 26.630 s
Press any key to continue.
|
```

Queue Implementation:

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

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

```
struct node
```

```
{
```

```
int data;
```

```
struct node *next;
```

```
};
```

```
struct queue
```

```
{
```

```

struct node *front;

struct node *rear;

};

struct queue *createQueue(){

    struct queue* q = (struct queue*)malloc(sizeof(struct queue));

    q->front = q->rear = NULL;

    return q;}

struct queue *q;

struct queue *insert(struct queue *,int);

struct queue *delete_element(struct queue *);

struct queue *display(struct queue *);

void main(){

int val, option;

q=createQueue(q);

while(1){

    printf("\n *****MAIN MENU*****");

    printf("\n 1. INSERT");

    printf("\n 2. DELETE");

    printf("\n 3. DISPLAY");

    printf("\n 4. EXIT");

    printf("\n Enter your option : ");

    scanf("%d", &option);

    switch(option) {

case 1:

    printf("\n Enter the number to insert in the queue:");

    scanf("%d", &val);

    q = insert(q,val);

    printf("\nThe value %d is inserted into the queue.\n",val);

    break;

case 2:

    q = delete_element(q);

    break;

```

```

case 3:
q = display(q);
break;
case 4:exit(0);
default:printf("Invalid input"); } } }

struct queue *insert(struct queue *q,int val){
struct node *ptr;
ptr = (struct node*)malloc(sizeof(struct node));
ptr -> data = val;
if(q -> front == NULL){
q -> front = ptr;
q -> rear = ptr;
q -> front -> next = q -> rear -> next = NULL;}
else{
q -> rear -> next = ptr;
q -> rear = ptr;
q -> rear -> next = NULL;}
return q;}

struct queue *display(struct queue *q){
struct node *ptr;
ptr = q -> front;
if(ptr == NULL)
printf("\n QUEUE IS EMPTY\n");
else{
printf("\n");
while(ptr!=q -> rear) {
printf("%d\t", ptr -> data);
ptr = ptr -> next; }
printf("%d\t", ptr -> data);}
return q;}

struct queue *delete_element(struct queue *q){
struct node *ptr;

```

```

ptr = q -> front;

if(q -> front == NULL)

printf("\n UNDERFLOW\n");

else{

q -> front = q -> front -> next;

printf("\n The value being deleted is : %d\n", ptr -> data);

free(ptr);}

return q;

}

```

OUTPUT:

```

*****MAIN MENU*****
1. INSERT
2. DELETE
3. DISPLAY
4. EXIT
Enter your option : 1

Enter the number to insert in the queue:10

The value 10 is inserted into the queue.

*****MAIN MENU*****
1. INSERT
2. DELETE
3. DISPLAY
4. EXIT
Enter your option : 1

Enter the number to insert in the queue:20

The value 20 is inserted into the queue.

*****MAIN MENU*****
1. INSERT
2. DELETE
3. DISPLAY
4. EXIT
Enter your option : 3

10      20
*****MAIN MENU*****
1. INSERT
2. DELETE
3. DISPLAY
4. EXIT
Enter your option : 2

The value being deleted is : 10

```



```
"C:\Users\tanma\OneDrive\Di  X + v
Enter your option : 3
10      20
*****MAIN MENU*****
1. INSERT
2. DELETE
3. DISPLAY
4. EXIT
Enter your option : 2

The value being deleted is : 10

*****MAIN MENU*****
1. INSERT
2. DELETE
3. DISPLAY
4. EXIT
Enter your option : 3

20
*****MAIN MENU*****
1. INSERT
2. DELETE
3. DISPLAY
4. EXIT
Enter your option : 4

Process returned 0 (0x0)   execution time : 28.655 s
Press any key to continue.
|
```

LAB PROGRAM 7:

Write a program to Implement doubly link list with primitive operations.

- a) Create a doubly linked list.**
- b) Insert a new node to the left of the node.**
- c) Delete the node based on a specific value**
- d) Display the contents of the list**

```
#include <stdio.h>

#include <stdlib.h>

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

struct Node* head = NULL;

void createlist() {
    int i, n;
    struct Node* newNode;
    struct Node* temp;
    printf("Enter the number of elements:");
    scanf("%d", &n);
    for (i = 0; i < n; i++) {
        newNode = (struct Node*)malloc(sizeof(struct Node));
        printf("Enter the element: ");
        scanf("%d", &newNode->data);
        if (head == NULL) {
            head = temp = newNode;
            head->prev = NULL;
            temp->next = NULL;
        } else {
            temp->next = newNode;
```

```

    newNode->prev = temp;

    temp = newNode;

    temp->next = NULL; } }

printf("List created successfully.\n");}

void insertLeft(struct Node* temp, int data) {

    struct Node* newNode;

    if (temp == NULL) {

        printf("Target node doesn't exist!\n");

        return; }

    newNode = (struct Node*)malloc(sizeof(struct Node));

    newNode->data = data;

    newNode->next = temp;

    newNode->prev = temp->prev;

    if (temp->prev != NULL) {

        temp->prev->next = newNode; }

    temp->prev = newNode;

    if (head == temp) {

        head = newNode; }

    printf("Node inserted successfully.\n");}

void deleteNode(int key) {

    struct Node* current = head;

    while (current != NULL) {

        if (current->data == key) {

            if (current->prev != NULL) {

                current->prev->next = current->next; }

            if (current->next != NULL) {

                current->next->prev = current->prev;

            }

            if (current == head) {

                head = current->next; }

            free(current);

            printf("Node deleted successfully.\n");

```

```

        return; }

    current = current->next;}

printf("Node with value %d not found!\n", key);}

void printList() {
    struct Node* temp = head;

    if (temp == NULL) {
        printf("List is empty!\n");
        return; }

    printf("Doubly linked list: ");

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

    printf("\n");}

int main() {
    int choice, data, targetValue, deleteValue;

    while(1) {
        printf("\nDoubly Linked List Operations:\n");
        printf("1. Create linked list\n");
        printf("2. Insert left of node\n");
        printf("3. Delete node by value\n");
        printf("4. Print the list\n");
        printf("5. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1: createlist();
                break;

            case 2: printf("Enter the value of the node to insert left of: ");
                scanf("%d", &targetValue);
                printf("Enter the element to insert left of the node: ");
                scanf("%d", &data);

```

```

    struct Node* temp = head;

    while (temp != NULL) {
        if (temp->data == targetValue) {
            insertLeft(temp, data);

            break; }

        temp = temp->next; }

    break;

case 3: printf("Enter the value of the node to delete: ");

    scanf("%d", &deleteValue);

    deleteNode(deleteValue);

    break;

case 4: printList();

    break;

case 5: exit(0);

    break;

default:

    printf("Invalid choice!\n");

}

}

return 0;

}

```

OUTPUT:

```
"C:\Users\tanma\OneDrive\Di X + v

Doubly Linked List Operations:
1. Create linked list
2. Insert left of node
3. Delete node by value
4. Print the list
5. Exit
Enter your choice: 1
Enter the number of elements:3
Enter the element: 10
Enter the element: 20
Enter the element: 30
List created successfully.

Doubly Linked List Operations:
1. Create linked list
2. Insert left of node
3. Delete node by value
4. Print the list
5. Exit
Enter your choice: 2
Enter the value of the node to insert left of: 20
Enter the element to insert left of the node: 15
Node inserted successfully.

Doubly Linked List Operations:
1. Create linked list
2. Insert left of node
3. Delete node by value
4. Print the list
5. Exit
Enter your choice: 4
Doubly linked list: 10 15 20 30

Doubly Linked List Operations:
1. Create linked list
2. Insert left of node
3. Delete node by value
4. Print the list
5. Exit
```

```
"C:\Users\tanma\OneDrive\Dr  X + v
Doubly Linked List Operations:
1. Create linked list
2. Insert left of node
3. Delete node by value
4. Print the list
5. Exit
Enter your choice: 3
Enter the value of the node to delete: 20
Node deleted successfully.

Doubly Linked List Operations:
1. Create linked list
2. Insert left of node
3. Delete node by value
4. Print the list
5. Exit
Enter your choice: 4
Doubly linked list: 10 15 30

Doubly Linked List Operations:
1. Create linked list
2. Insert left of node
3. Delete node by value
4. Print the list
5. Exit
Enter your choice: 5

Process returned 0 (0x0)   execution time : 60.524 s
Press any key to continue.
```

LAB PROGRAM 8:

Write a program

- a) To construct a binary Search tree.
- b) To traverse the tree using all the methods i.e., in-order, preorder and post order
- c) To display the elements in the tree.

```
#include <stdio.h>
#include <conio.h>
#include <malloc.h>

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

struct node *tree=NULL;

struct node *insertElement(struct node *, int);

void preorderTraversal(struct node *);
void inorderTraversal(struct node *);
void postorderTraversal(struct node *);

void main(){
int option, val;
while(1){
printf("\n\n *****MAIN MENU***** \n");
printf("\n 1. Insert Element");
printf("\n 2. Preorder Traversal");
printf("\n 3. Inorder Traversal");
printf("\n 4. Postorder Traversal");
printf("\n 5. Exit");
printf("\n Enter your option : ");
scanf("%d", &option);
switch(option){
```



```

case 1:

printf("\n Enter the value of the new node : ");

scanf("%d", &val);

tree = insertElement(tree, val);

break;

case 2:

printf("\n The elements of the tree are : \n");

preorderTraversal(tree);

break;

case 3:

printf("\n The elements of the tree are : \n");

inorderTraversal(tree);

break;

case 4:

printf("\n The elements of the tree are : \n");

postorderTraversal(tree);

break;

case 5:exit(0);

default:printf("Invalid input");} } }

struct node *insertElement(struct node *tree, int val){

struct node *ptr, *nodeptr, *parentptr;

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

ptr->data = val;

ptr->left = NULL;

ptr->right = NULL;

if(tree==NULL){

tree=ptr;

tree->left=NULL;

tree->right=NULL;}

else{

parentptr=NULL;

nodeptr=tree;

```

```

while(nodeptr!=NULL) {
parentptr=nodeptr;
if(val<nodeptr->data)
nodeptr=nodeptr->left;
else
nodeptr = nodeptr->right; }
if(val<parentptr->data)
parentptr->left = ptr;
else
parentptr->right = ptr;}
return tree;}

void preorderTraversal(struct node *tree){
if(tree != NULL){
printf("%d\t", tree->data);
preorderTraversal(tree->left);
preorderTraversal(tree->right);} }

void inorderTraversal(struct node *tree){
if(tree != NULL){
inorderTraversal(tree->left);
printf("%d\t", tree->data);
inorderTraversal(tree->right);} }

void postorderTraversal(struct node *tree){
if(tree != NULL){
postorderTraversal(tree->left);
postorderTraversal(tree->right);
printf("%d\t", tree->data);}
}

```

OUTPUT:

```
C:\Users\tanma\OneDrive\Do  X  +  v

*****MAIN MENU*****

1. Insert Element
2. Preorder Traversal
3. Inorder Traversal
4. Postorder Traversal
5. Exit
Enter your option : 1

Enter the value of the new node : 7

*****MAIN MENU*****

1. Insert Element
2. Preorder Traversal
3. Inorder Traversal
4. Postorder Traversal
5. Exit
Enter your option : 1

Enter the value of the new node : 5

*****MAIN MENU*****

1. Insert Element
2. Preorder Traversal
3. Inorder Traversal
4. Postorder Traversal
5. Exit
Enter your option : 1

Enter the value of the new node : 5
```

```
C:\Users\tanma\OneDrive\Do  ×  +  ∨

*****MAIN MENU*****

1. Insert Element
2. Preorder Traversal
3. Inorder Traversal
4. Postorder Traversal
5. Exit
Enter your option : 1

Enter the value of the new node : 8

*****MAIN MENU*****

1. Insert Element
2. Preorder Traversal
3. Inorder Traversal
4. Postorder Traversal
5. Exit
Enter your option : 1

Enter the value of the new node : 3

*****MAIN MENU*****

1. Insert Element
2. Preorder Traversal
3. Inorder Traversal
4. Postorder Traversal
5. Exit
Enter your option : 2

The elements of the tree are :
7       5       3       5       8
```

```
C:\Users\tanma\OneDrive\Do × + ∨  
7      5      3      5      8  
  
*****MAIN MENU*****  
  
1. Insert Element  
2. Preorder Traversal  
3. Inorder Traversal  
4. Postorder Traversal  
5. Exit  
Enter your option : 3  
  
The elements of the tree are :  
3      5      5      7      8  
  
*****MAIN MENU*****  
  
1. Insert Element  
2. Preorder Traversal  
3. Inorder Traversal  
4. Postorder Traversal  
5. Exit  
Enter your option : 4  
  
The elements of the tree are :  
3      5      5      8      7  
  
*****MAIN MENU*****  
  
1. Insert Element  
2. Preorder Traversal  
3. Inorder Traversal  
4. Postorder Traversal  
5. Exit  
Enter your option : 5  
  
Process returned 0 (0x0)   execution time : 54.695 s  
Press any key to continue.  
|
```

LAB PROGRAM 9:

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

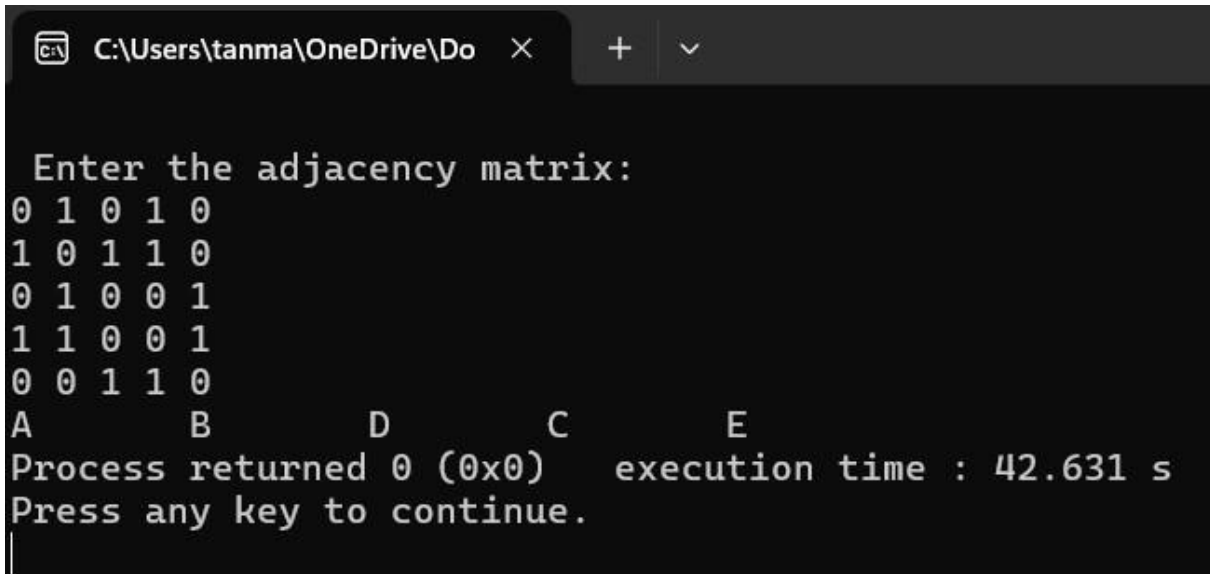
```
#include <stdio.h>

#define MAX 5

void breadth_first_search(int adj[][MAX],int visited[],int start){
    int queue[MAX],rear = -1,front = -1, i;
    queue[++rear] = start;
    visited[start] = 1;
    while(rear != front){
        start = queue[++front];
        if(start == 4)
            printf("%c\t",start+65);
        else
            printf("%c \t",start + 65);
        for(i = 0; i < MAX; i++) {
            if(adj[start][i] == 1 && visited[i] == 0){
                queue[++rear] = i;
                visited[i] = 1; } }
    }
}

int main(){
    int visited[MAX] = {0};
    int adj[MAX][MAX], i, j;
    printf("\n Enter the adjacency matrix: ");
    for(i = 0; i < MAX; i++)
        for(j = 0; j < MAX; j++)
            scanf("%d", &adj[i][j]);
    breadth_first_search(adj,visited,0);
    return 0;
}
```

OUTPUT:



```
C:\Users\tanma\OneDrive\Do x + v

Enter the adjacency matrix:
0 1 0 1 0
1 0 1 1 0
0 1 0 0 1
1 1 0 0 1
0 0 1 1 0
A      B      D      C      E
Process returned 0 (0x0)   execution time : 42.631 s
Press any key to continue.
```

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

```
#include <stdbool.h>

#include <stdio.h>

#include <string.h>

#define N 50

int gr[N][N];

bool vis[N];

void Add_edge(int u, int v){

    gr[u][v] = 1;}

void dfs(int x){

    vis[x] = true;

    for (int i = 1; i <= N; i++)

        if (gr[x][i] && !vis[i])

            dfs(i);}

bool Is_Connected(int n){

    memset(vis, false, sizeof vis);

    dfs(1);
```

```

    for (int i = 1; i <= n; i++){
        if (!vis[i])
            return false; }
    return true;}

int main(){
    int n, u, v;

    printf("Enter the number of vertices: ");
    scanf("%d", &n);

    printf("Enter the number of edges: ");
    int m;
    scanf("%d", &m);

    printf("Enter the edges (u v):\n");
    for (int i = 0; i < m; ++i) {
        scanf("%d %d", &u, &v);

        Add_edge(u, v); }

    if (Is_Connected(n))
        printf("Connected\n");
    else
        printf("Not Connected\n");

    return 0;
}

```

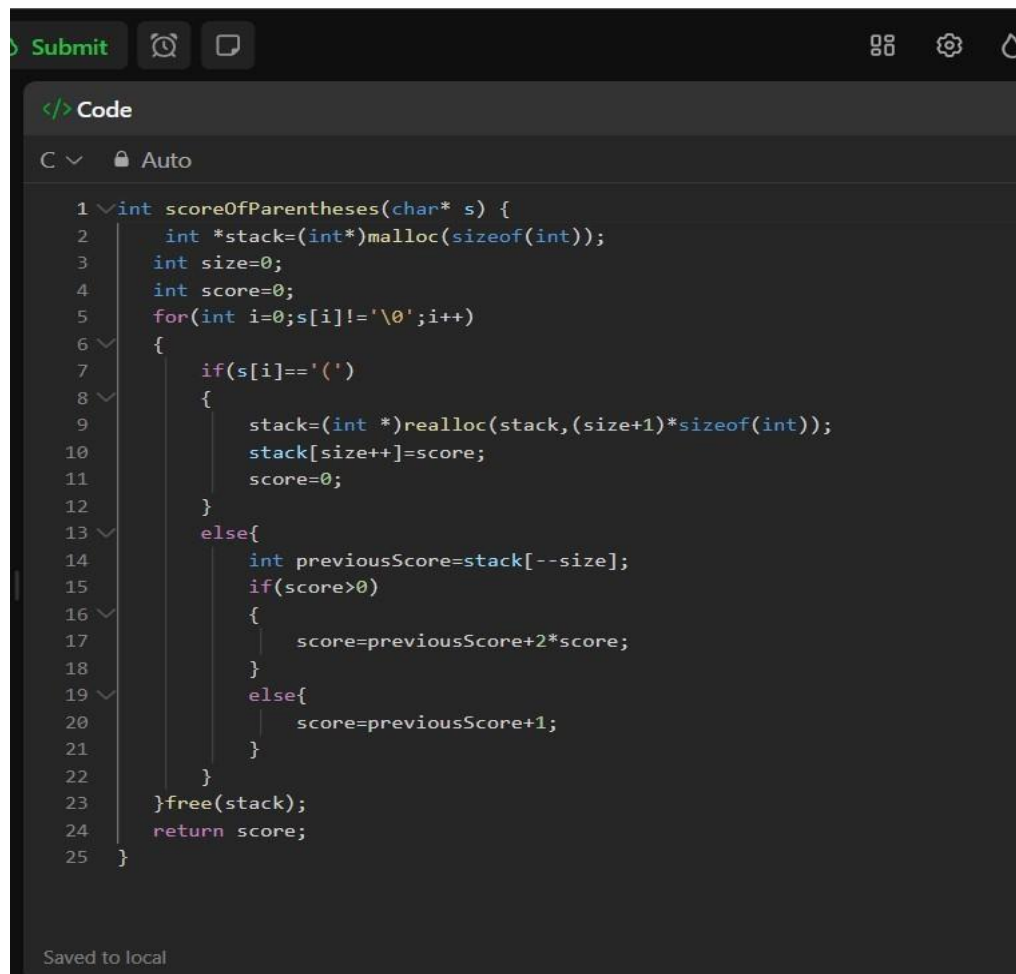

OUTPUT:

```
Enter the number of vertices: 4
Enter the number of edges: 4
Enter the edges (u v):
1 2
1 3
2 3
3 4
Connected
```

```
Enter the number of vertices: 5
Enter the number of edges: 4
Enter the edges (u v):
1 2
4 3
4 5
2 3
Not Connected
```

LeetCode Programs:

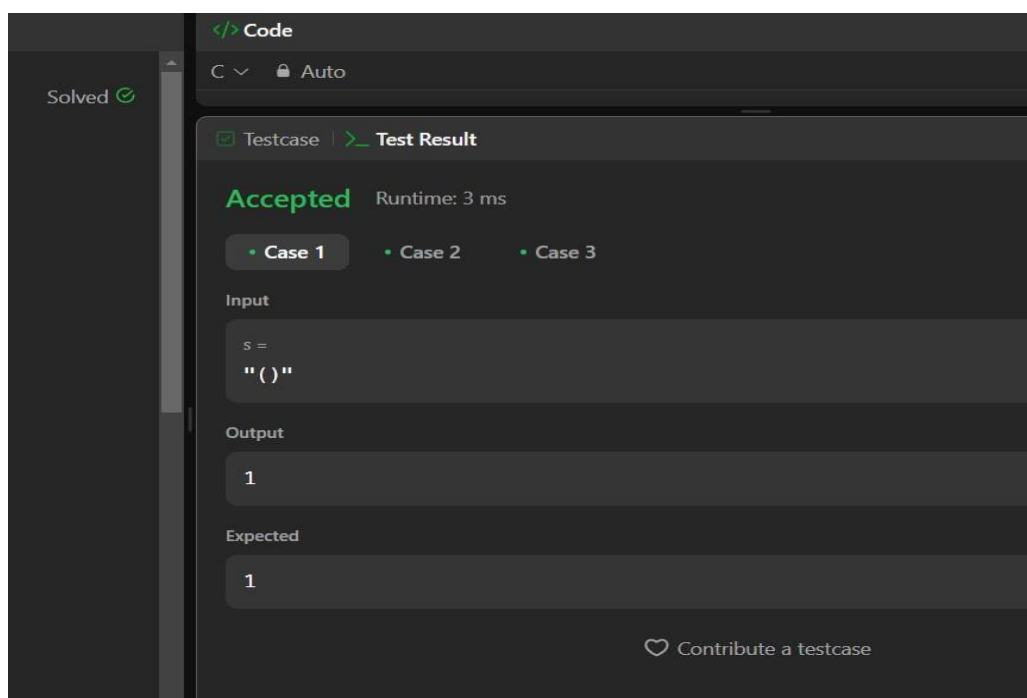
1. Score of Parentheses(LP:856)



The screenshot shows a code editor with a dark theme. At the top, there's a 'Submit' button and some icons. Below that, a 'Code' tab is active. The code is written in C and implements a stack-based solution for calculating the score of a parentheses string. The code is as follows:

```
1 int scoreOfParentheses(char* s) {
2     int *stack=(int*)malloc(sizeof(int));
3     int size=0;
4     int score=0;
5     for(int i=0;s[i]!='\0';i++)
6     {
7         if(s[i]=='(')
8         {
9             stack=(int *)realloc(stack,(size+1)*sizeof(int));
10            stack[size++]=score;
11            score=0;
12        }
13        else{
14            int previousScore=stack[--size];
15            if(score>0)
16            {
17                score=previousScore+2*score;
18            }
19            else{
20                score=previousScore+1;
21            }
22        }
23    }free(stack);
24    return score;
25 }
```

At the bottom left, it says 'Saved to local'.



The screenshot shows the LeetCode test result page for the 'Score of Parentheses' problem. On the left, there's a 'Solved' status with a green checkmark. The main area shows the 'Test Result' tab, which indicates 'Accepted' with a runtime of 3 ms. Below this, there are three tabs for 'Case 1', 'Case 2', and 'Case 3'. The 'Case 1' tab is selected, showing the input 's = "()"'. The output is '1', and the expected result is also '1'. At the bottom right, there's a link to 'Contribute a testcase'.

2. Odd Even Linked List(LP:328)

</> Code

C v Auto

```
7  /*
8  struct ListNode* oddEvenList(struct ListNode* head) {
9      struct ListNode *odd=head;
10     struct ListNode *even=head->next;
11     struct ListNode *evenlist=even;
12     while(odd->next != NULL && even->next != NULL)
13     {
14         odd->next=even->next;
15         odd=odd->next;
16         even->next=odd->next;
17         even=even->next;
18     }
19     odd->next=evenlist;
20     return head;
21 }
```

Saved to local

☒ Testcase | >_ Test Result

Accepted Runtime: 0 ms

• Case 1 • Case 2



Input





head =
[1,2,3,4,5]

Output



3.Delete middle node of linked list.(LP:2095)

Submit




 0

</> Code

C  Auto 

```
8 struct ListNode* deleteMiddle(struct ListNode* head) {
9     struct ListNode *temp,*ptr,*ptr1;
10    temp=head;
11    ptr1=head;
12    if(head ==NULL || head->next==NULL)
13        return NULL;
14    while(temp!=NULL && temp->next != NULL)
15    {
16        temp=temp->next->next;
17        ptr=ptr1;
18        ptr1=ptr1->next;
19    }
20    ptr->next=ptr1->next;
21    return head;
```

Saved to local

☒ Testcase |  Test Result

Accepted Runtime: 0 ms

• Case 1

• Case 2

• Case 3

Input

head =
[1,3,4,7,1,2,6]

4. Delete a node in BST.(LP:450)

```
</> Code
C v Auto
8  */
9  struct TreeNode *smallest(struct TreeNode *root)
10 {
11     struct TreeNode *cur=root;
12     while(cur->left != NULL)
13         cur=cur->left;
14     return cur;
15 }
16
17 struct TreeNode* deleteNode(struct TreeNode* root, int key) {
18     if(root == NULL)
19         return root;
20
21     if(key<root->val)
22         root->left = deleteNode(root->left,key);
23     else if(key > root->val)
24         root->right = deleteNode(root->right,key);
25     else
26     {
27         if(root->left == NULL)
28         {
29             struct TreeNode *temp =root->right;
30             free(root);
31             return temp;
32         }
33         else if(root->right == NULL)
34         {
35             struct TreeNode *temp=root->left;
```

```
</> Code
C v Auto
32     }
33     else if(root->right == NULL)
34     {
35         struct TreeNode *temp=root->left;
36         free(root);
37         return temp;
38     }
39     struct TreeNode *temp= smallest(root->right);
40     root->val=temp->val;
41     root->right = deleteNode(root->right,root->val);
42 }
43 return root;
44 **
Saved to local

Testcase | >_ Test Result
Accepted Runtime: 0 ms
• Case 1 • Case 2 • Case 3
Input
root =
[5,3,6,2,4,null,7]
key =
3
Output
```

5. Bottom Left Tree Value.(LP:513)

```
</> Code
C v Auto
8  */
9  int findBottomLeftValue(struct TreeNode* root) {
10     struct TreeNode *queue[100000];
11     int front=0,rear=0;
12     queue[rear++]=root;
13     int leftmostValue=root->val;
14
15     while(front<rear)
16     {
17         int levelSize = rear-front;
18         for(int i=0;i<levelSize;i++)
19         {
20             struct TreeNode *current=queue[front++];
21             if(i==0)
22                 leftmostValue=current->val;
23             if(current->left != NULL)
24                 queue[rear++]=current->left;
25             if(current->right != NULL)
26                 queue[rear++]=current->right;
27         }
28     }
29     return leftmostValue;
30 }
```

```
</> Code
C v Auto
8  */
9  int findBottomLeftValue(struct TreeNode* root) {
Saved to local

Testcase | >_ Test Result

Accepted Runtime: 5 ms

• Case 1 • Case 2

Input
root =
[1,2,3,4,null,5,6,null,null,7]

Output
7

Expected
7
```