VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

Data Structures using C Lab

(23CS3PCDST)

Submitted by

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(1BM23CS313)

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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Bull Temple Road, Bangalore 560019
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Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "Data Structures using C Lab (23CS3PCDST)" carried out by **SHASHANK SHANTHARAM NAYAK(1BM23CS313),** 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. The Lab report has been approved as it satisfies the academicrequirements in respect of Data Structures using C Lab (23CS3PCDST) work prescribed for the said degree.

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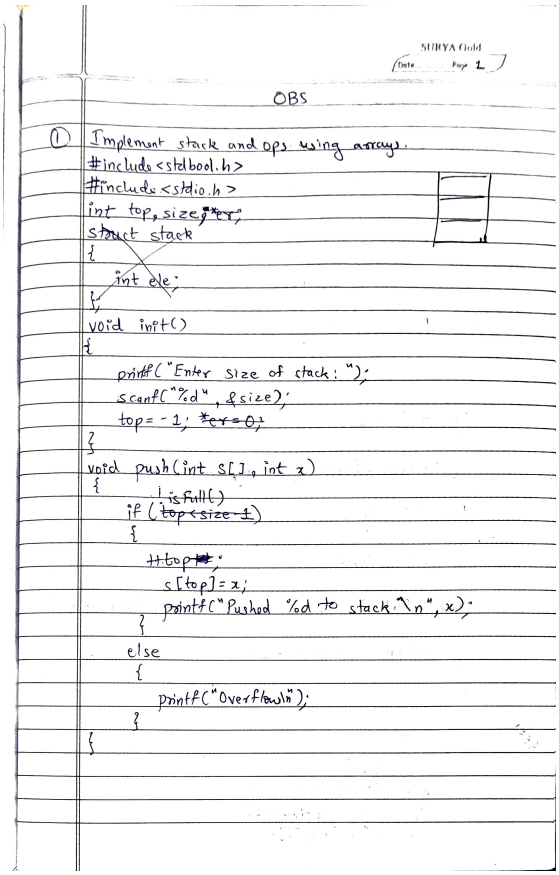
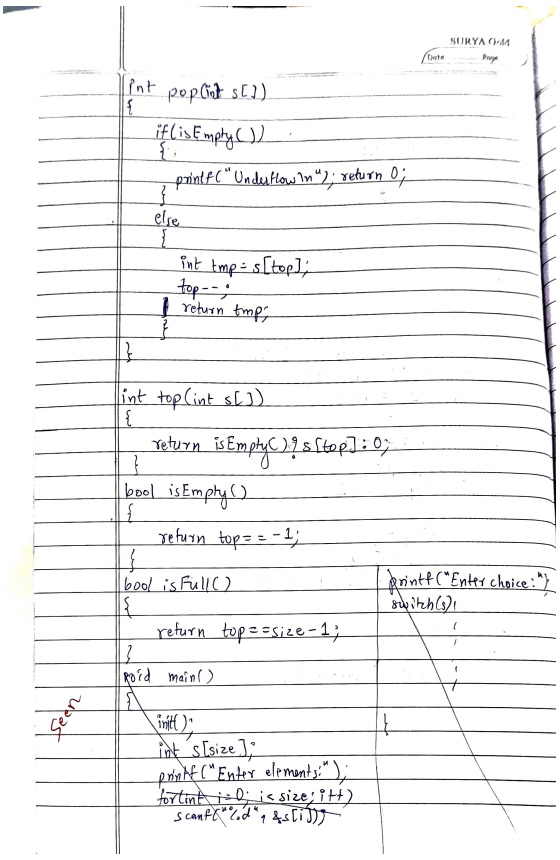
Github Link:
https://github.com/DevelSSN/1BM23CS313-SHASHANK-SHANTHARAM-NAYAK

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



```
OBS
① Implement stack and ops using arrays.
#include <stdbool.h>
#include <stdio.h>
int top, size, *arr;
struct stack
{
    int ele;
};
void init()
{
    printf("Enter size of stack: ");
    scanf("%d", &size);
    top = -1; *arr = 0;
}
void push(int s[], int x)
{
    isfull()
    if (top < size-1)
    {
        ++top;
        s[top] = x;
        printf("Pushed %d to stack.\n", x);
    }
    else
    {
        printf("Overflow\n");
    }
}
```



```
int pop(int s[])
{
    if(isEmpty())
    {
        printf("Underflow\n"); return 0;
    }
    else
    {
        int tmp = s[top];
        top--;
        return tmp;
    }
}

int top(int s[])
{
    return isEmpty()? s[top] : 0;
}
bool isEmpty()
{
    return top == -1;
}
bool isFull()
{
    return top == size-1;
}
void main()
{
    init();
    int s[size];
    printf("Enter elements:");
    for(int i=0; i<size; i++)
        scanf("%d", &s[i]);
}
printf("Enter choice:");
switch(c)
```

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```
void display(int s[])
{
    if (!isEmpty())
    {
        printf("Elements are: \t");
        for(int i=0; i<=top; i++)
        {
            printf("%d \t", s[i]);
        } printf("\n");
    }
    else
    {
        printf("No element to display\n");
    }
}
void main()
{
    init();
    int s[size];
    char c, choice;
    do
    {
        printf("\n\n Operations: \n");
        printf("push(p) \t\t pop(P) \n Top(t) \t\t Display(d) \n
            Empty(e) \t Full(f) \n 0 to exit \n Enter choice:");
        // Flush
        while((c = getchar()) != '\n' && c != EOF) { }
        scanf("%c", &choice);

        switch(choice)
        {
```

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```
            case 'p': int x;
                printf("Enter element: ");
                scanf("%d", &x);
                push(s, x);
                break;
            case 'P': printf("Element %d popped\n", pop(s));
                break;
            case 'e': if(isEmpty())
                    printf("Empty stack\n");
                else
                    printf("Not Empty\n");
                break;
            case 't': printf("Top element: %d\n", Top(s));
                break;
            case 'f': if(isFull())
                    printf("Stack is full\n");
                else
                    printf("Stack is not full\n");
                break;
            case 'd': display(s);
                break;
            case '0': break;
            default: break;
        }
    }while(choice != '0');
    printf("\n Exiting...\n");
}
```

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Output:

Enter the size of stack: 3

Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: p
Enter element: 4
Pushed 4 to stack

Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: p
Enter element: 5
Pushed 5 to stack

Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: p
Enter element: 6
Pushed 6 to stack

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Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: p
Enter element: 7
Overflow

Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: P
Element 6 popped

Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: P
Element 5 popped

Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: P
Element 4 popped

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Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: P
Underflow
Element 0 popped

Operations:
push(p) pop(P)
Top(t) Display(d)
Empty(e) Full(F)
0 to exit
Enter choice: 0

Exiting...

olp Seen

Code:

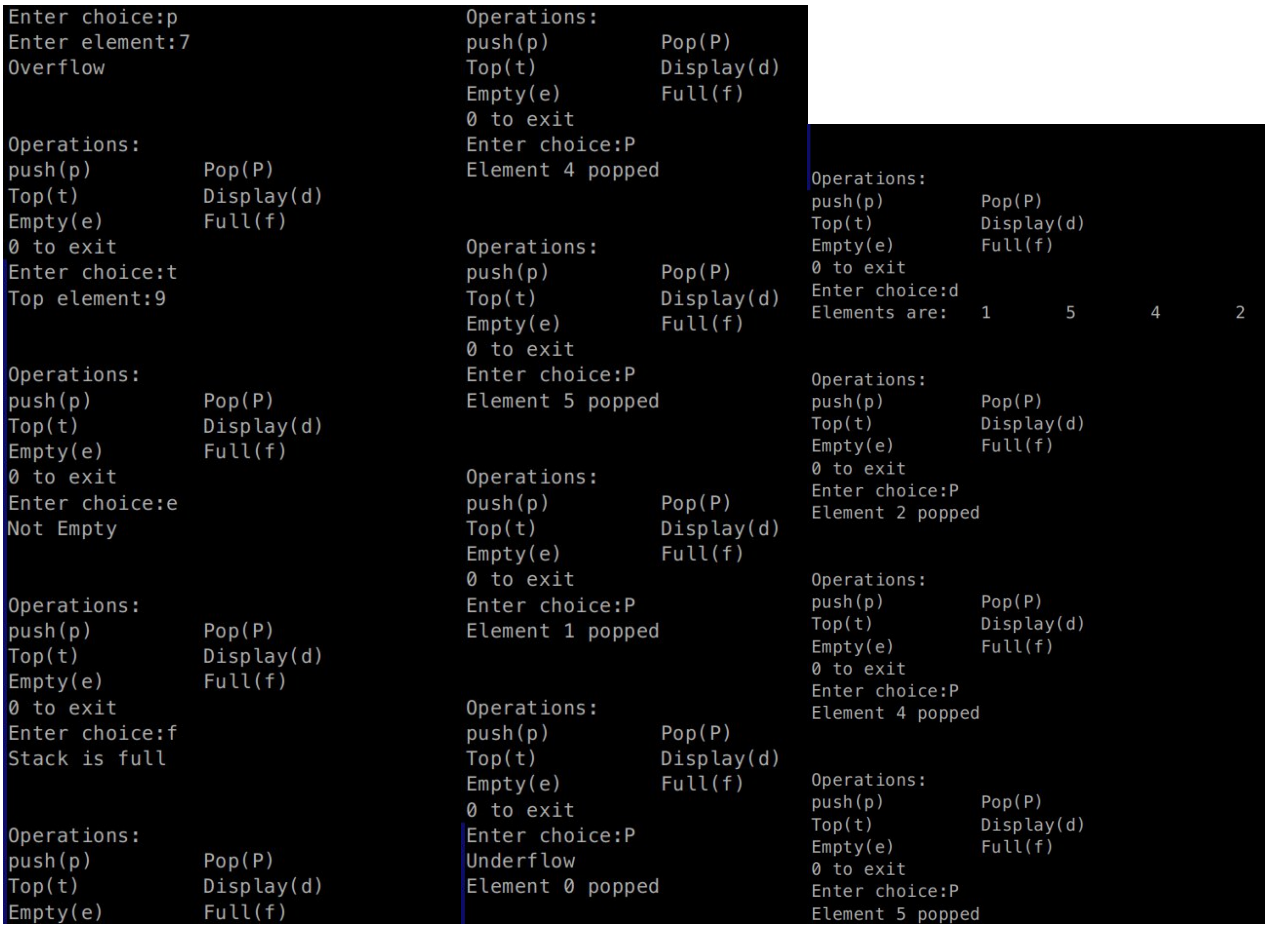
```
#include <stdbool.h>
#include <stdio.h>
int top, size;

void init()
{
	printf("Enter the size of stack:");
	scanf("%d",&size);
	top=-1;
}

bool isEmpty()
{return top==-1;}

bool isFull()
{return top==size-1;}

void push(int s[], int x)
{
	if(!isFull())
	{
		++top;
		s[top]=x;
		printf("Pushed %d to stack\n",x);
		printf("%d",top);
	}
	else
	{
		printf("Overflow\n");
	}
}

int pop(int s[])
{
	if(isEmpty())
	{
		printf("Underflow\n");
		return 0;
	}
	else
	{
		int tmp=s[top];
		top--;
		return tmp;
	}
}
```

```
int Top(int s[])
{return s[top];}

void display(int s[])
{
	if(!isEmpty())
	{
		printf("Elements are:\t");
		for(int i=0;i<=top;i++)
			printf("%d\t", s[i]);
		printf("\n");
	}
	else
		printf("No element to display\n");
}

void main()
{
	init();
	int s[size];
	char choice, c;
	do{
	printf("\n\nOperations:\n");
	printf("push(p)\t\tPop(P)\nTop(t)\t\tDisplay(d)\nEmpty(e)\tFull(f)\n0 to exit\nEnter choice:");
	// Flush stdin
	while ((c = getchar()) != '\n' && c != EOF) { }
	// TODO input here
	scanf("%c",&choice);
	switch(choice)
	{
		case 'p':int x;
			printf("Enter element:");
			scanf("%d",&x);
			push(s,x);
			break;
		case 'P':printf("Element %d popped\n",pop(s));
			break;
		case 'e':if(isEmpty())
				printf("Empty Stack\n");
			else
				printf("Not Empty\n");
			break;
		case 't':printf("Top element:%d\n",Top(s));
			break;
		case 'f':if(isFull())
				printf("Stack is full\n");
			else
```

```
                        printf("Stack is not full\n");
                    break;
                case 'd':display(s);
                    break;
                case '0': break;
                default: break;
        }
        }while(choice!='0');
        printf("\nExiting...\n");
}
```

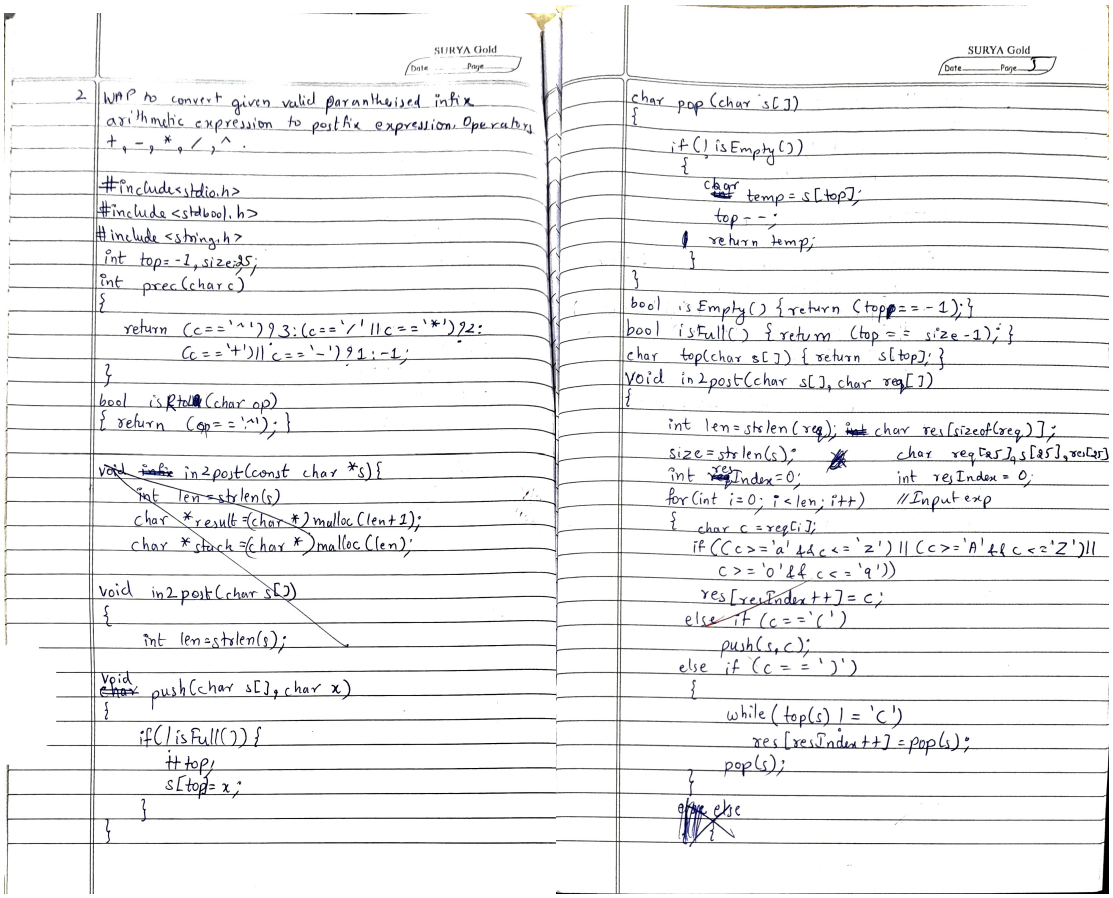
OUTPUT

```
❯ ./stack
Enter the size of stack:5

Operations:
push(p)         Pop(P)
Top(t)          Display(d)
Empty(e)        Full(f)
0 to exit
Enter choice:p
Enter element:1
Pushed 1 to stack
0

Operations:
push(p)         Pop(P)
Top(t)          Display(d)
Empty(e)        Full(f)
0 to exit
Enter choice:p
Enter element:5
Pushed 5 to stack
1

Operations:
push(p)         Pop(P)
Top(t)          Display(d)
Empty(e)        Full(f)
0 to exit
Enter choice:p
Enter element:4
Pushed 4 to stack
2

Operations:
push(p)         Pop(P)
Top(t)          Display(d)
Empty(e)        Full(f)
0 to exit
Enter choice:p
Enter element:2
Pushed 2 to stack
3

Operations:
push(p)         Pop(P)
Top(t)          Display(d)
Empty(e)        Full(f)
0 to exit
Enter choice:p
Enter element:9
Pushed 9 to stack
4

Operations:
push(p)         Pop(P)
Top(t)          Display(d)
Empty(e)        Full(f)
0 to exit
Enter choice:p
Enter element:7
Overflow


Operations:
push(p)         Pop(P)
Top(t)          Display(d)
Empty(e)        Full(f)
0 to exit
```


Enter choice:p
Enter element:7
Overflow
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:t
Top element:9
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:e
Not Empty
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:f
Stack is full
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:P
Element 4 popped
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:P
Element 5 popped
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:P
Element 1 popped
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:P
Underflow
Element 0 popped
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:d
Elements are: 1 5 4 2
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:P
Element 2 popped
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:P
Element 4 popped
Operations:
push(p) Pop(P)
Top(t) Display(d)
Empty(e) Full(f)
0 to exit
Enter choice:P
Element 5 popped

Program 2

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



```
2 WAP to convert given valid paranthesised infix
arithmetic expression to postfix expression. Operators
+, -, *, /, ^.

#include<stdio.h>
#include<stdbool.h>
#include<string.h>
int top=-1, size=25;
int prec(char c)
{
    return (c=='^')?3:(c=='/'||c=='*')?2:
           (c=='+'||c=='-')?1:-1;
}
bool isRtol(char op)
{ return (op=='^'); }

void infix in2post(const char *s){
    int len=strlen(s)
    char *result=(char *)malloc(len+1);
    char *stack=(char *)malloc(len);

void in2post(char s[])
{
    int len=strlen(s);

Void
Char push(char s[], char x)
{
    if(!isFull()){
        ++top;
        s[top]=x;
    }
}
```

```
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char pop(char s[])
{
    if(!isEmpty())
    {
        char temp=s[top];
        top--;
        return temp;
    }
}
bool isEmpty(){return (top==-1);}
bool isFull(){return (top==size-1);}
char top(char s[]){return s[top];}
void in2post(char s[], char req[])
{
    int len=strlen(req); char res[sizeof(req)];
    size=strlen(s);                char req[85],s[85],res[85]
    int resIndex=0;                int resIndex=0;
    for(int i=0; i<len; i++)       //Input exp
    {   char c=req[i];
        if((c>='a'&&c<='z')||(c>='A'&&c<='Z')||
           c>='0'&&c<='9'))
            res[resIndex++]=c;
        else if(c=='(')
            push(s,c);
        else if(c==')')
        {
            while(top(s)!='(')
                res[resIndex++]=pop(s);
            pop(s);
        }
        else
```
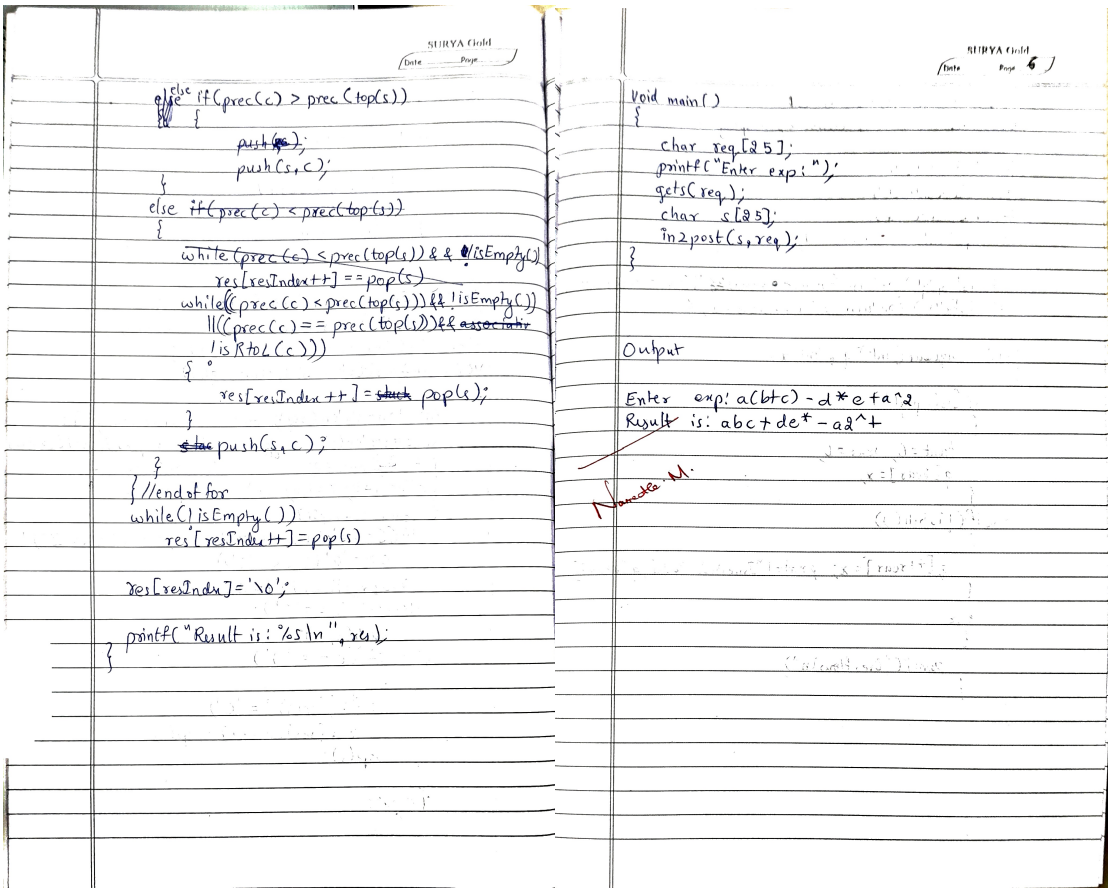



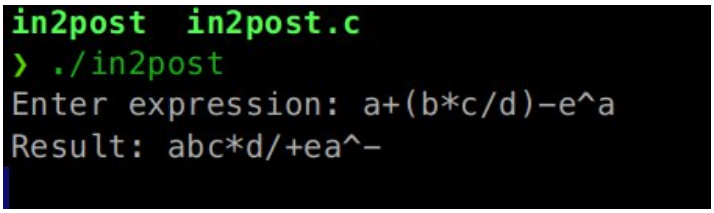
Code:

```
#include <stdio.h>
#include <stdbool.h>
#include <string.h>
int top=-1, size=25;

int prec(char c){
        return (c=='^')?3:(c=='/'||c=='*')?2:(c=='+'||c=='-')?1:-1;
}

bool isEmpty(){return (top==-1);}
bool isFull(){return (top==size-1);}

bool isRtoL(char op){return (op=='^');}

char Top(char s[]){if (!isEmpty()) {
      return s[top];
   }
   return '\0';  }
void push(char s[], char x)
{
        if (!isFull()) {
```

```
        ++top;
        s[top] = x;
    }
}

char pop(char s[]){
          if (!isEmpty()) {
        return s[top--];
    }
    return '\0';
}

void in2post(){
    char req[25];
    char s[25];  // Stack for operators
    char res[25];  // Result array
    int resIndex = 0;

    printf("Enter expression: ");
    fgets(req, sizeof(req), stdin);

    int len = strlen(req);
    memset(res, 0, sizeof(res));  // Clear result array

    for (int i = 0; i < len; i++) {
        char c = req[i];

        if ((c >= 'a' && c <= 'z') || (c >= 'A' && c <= 'Z') || (c >= '0' && c <= '9')) {
            res[resIndex++] = c;  // Append operand to result
        } else if (c == '(') {
            push(s, c);  // Push '(' to stack
        } else if (c == ')') {
            while (!isEmpty() && Top(s) != '(') {
                res[resIndex++] = pop(s);
            }
            pop(s);  // Pop '(' from stack
        } else if (prec(c) > prec(Top(s))) {
            push(s, c);  // Push operator to stack
        } else {
            while (!isEmpty() && ((prec(c) < prec(Top(s))) || (prec(c) == prec(Top(s)) && !isRtoL(c))))
{
                res[resIndex++] = pop(s);
            }
            push(s, c);
        }
    }

    // Clear stack
```

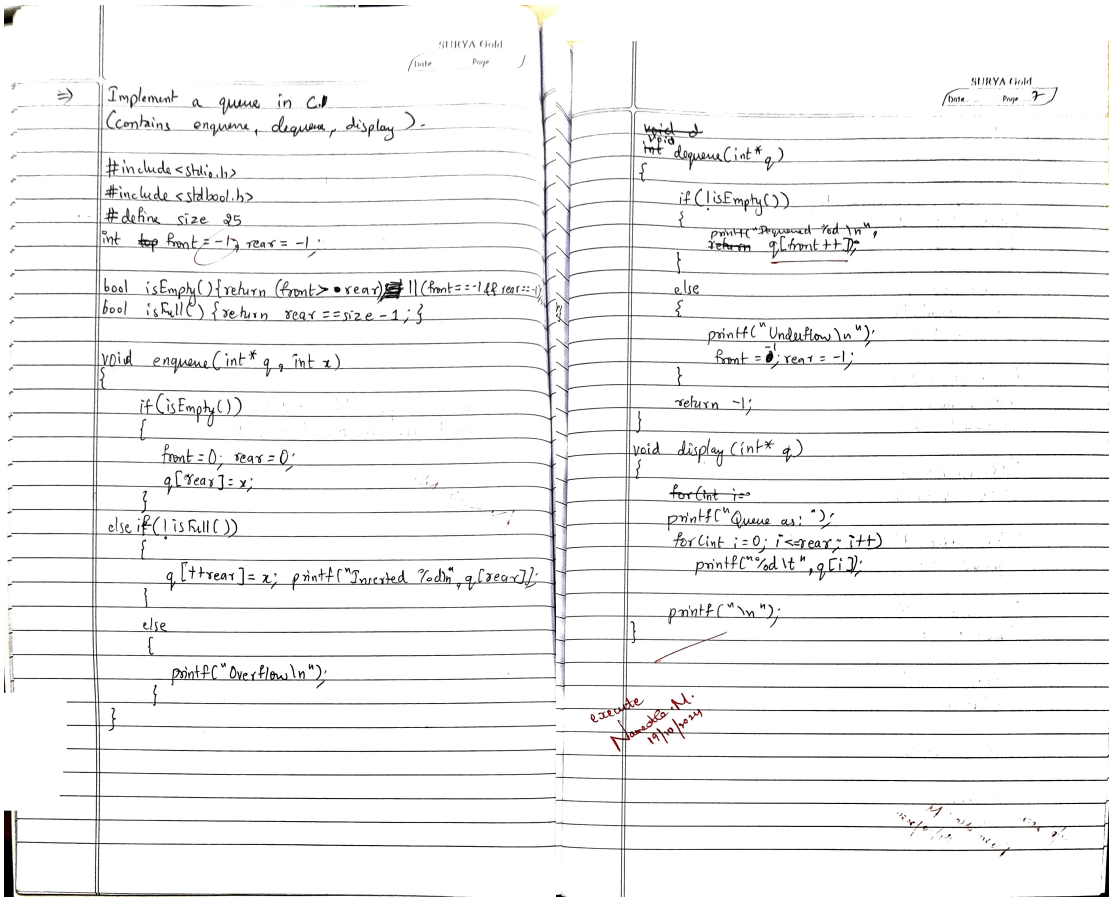
```
    while (!isEmpty()) {
        res[resIndex++] = pop(s);
    }

    res[resIndex] = '\0';  // Null-terminate the result string
    printf("Result: %s\n", res);
}

void main()
{
        in2post();
}
```

OUTPUT

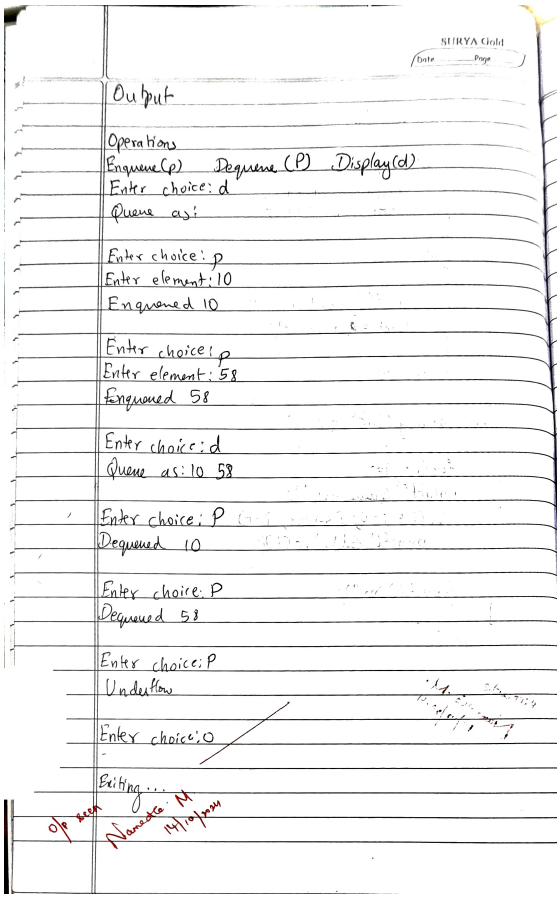


Program 3:

3a) WAP to simulate the working of a queue of integers using an array. Provide the following operations: Insert, Delete, Display The program should print appropriate messages for queue empty and queue overflow conditions.



```
Implement a queue in C
(Contains enqueue, dequeue, display).

#include<stdio.h>
#include<stdbool.h>
#define size 25
int front=-1, rear=-1;

bool isEmpty(){return (front>rear)||(front==-1&&rear==-1);}
bool isFull(){return rear==size-1;}

void enqueue(int* q, int x)
{
    if(isEmpty())
    {
        front=0; rear=0;
        q[rear]=x;
    }
    else if(!isFull())
    {
        q[++rear]=x; printf("Inserted %d\n",q[rear]);
    }
    else
    {
        printf("Overflow\n");
    }
}

int dequeue(int* q)
{
    if(!isEmpty())
    {
        printf("Deleted %d\n",q[front++]);
    }
    else
    {
        printf("Underflow\n");
        front=0; rear=-1;
    }
    return -1;
}
void display(int* q)
{
    printf("Queue as: ");
    for(int i=0; i<=rear; i++)
        printf("%d\t",q[i]);

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



Code:

```
#include <stdio.h>
#include <stdbool.h>
#define size 5
int front=-1, rear=-1;
bool isEmpty(){return (front>rear)||(front==-1&&rear==-1);}
bool isFull(){return rear==size-1;}

void enqueue(int* q, int x)
{
	if(isEmpty())
	{
		front=0; rear=0;
		q[rear]=x;
	}
	else if(!isFull())
	{
		q[++rear]=x;
		printf("Enqueued %d\n",q[rear]);
	}
	else
```

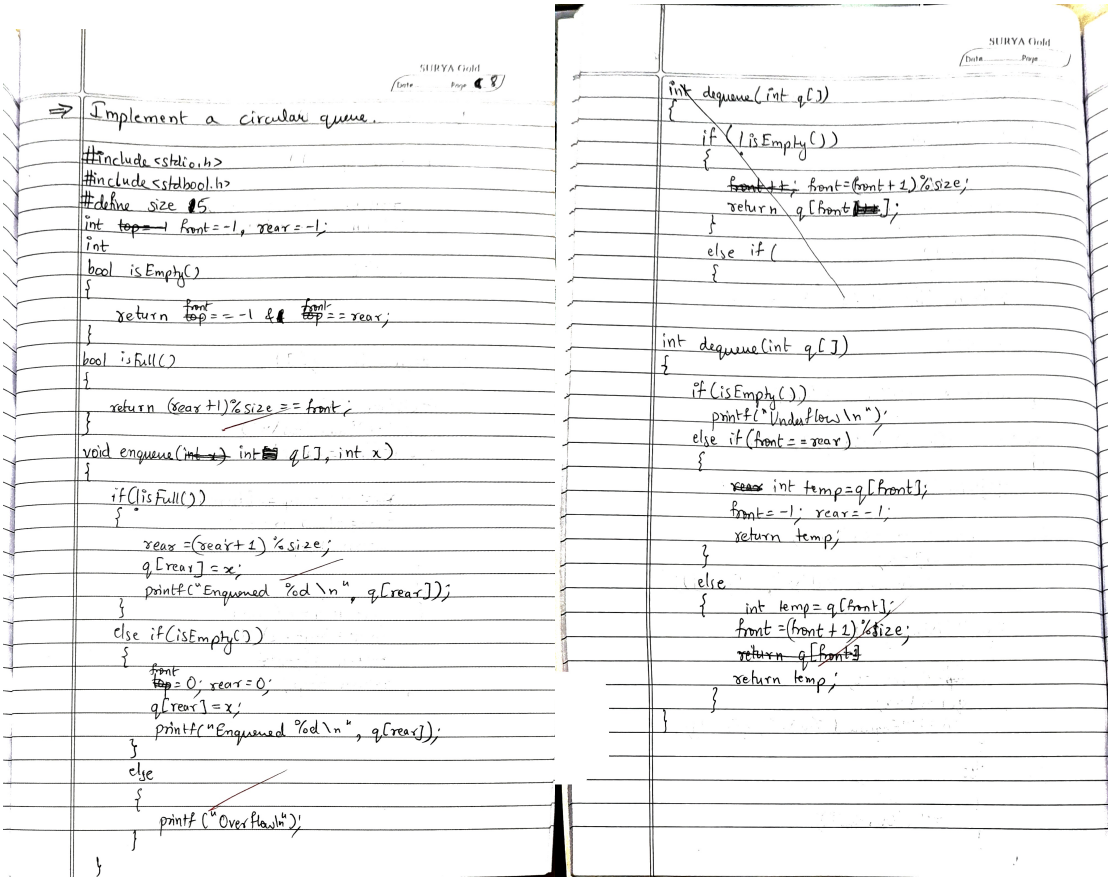
```
	{
		printf("Overflow\n");
	}
}

void dequeue(int* q)
{
	if(!isEmpty())
	{
		printf("Dequeued %d\n", q[front++]);
	}
	else
	{
		printf("Underflow\n");
		front=-1;rear=-1;
	}
}
void display(int* q)
{
	printf("Queue as:");
	for(int i=0;i<=rear;i++)
		printf("%d\t",q[i]);
	printf("\n");
}

void main()
{
	int q[size];
	char choice, c;
	printf("\n\nOperations:\n");
	printf("Enqueue(p)\t\tDequeue(P)\t\tDisplay(d)\n0 to exit\n");
	do{
		// TODO input here
		printf("\nEnter choice:");
		scanf("%c",&choice);
	switch(choice)
	{
		case 'p':int x;
			printf("Enter element:");
			scanf("%d",&x);
			enqueue(q,x);
			break;
		case 'P':dequeue(q);
			break;
		case 'e':if(isEmpty())
				printf("Empty Stack\n");
			else
```

```
                printf("Not Empty\n");
            break;
        case 'f':if(isFull())
                printf("Stack is full\n");
            else
                printf("Stack is not full\n");
            break;
        case 'd':display(q);
            break;
        case '0': break;
        default: break;
    }
    // Flush stdin
    if((c=getchar())=='\n'||c==EOF){}
    }while(choice!='0');
    printf("\nExiting...\n");
}
```

OUTPUT

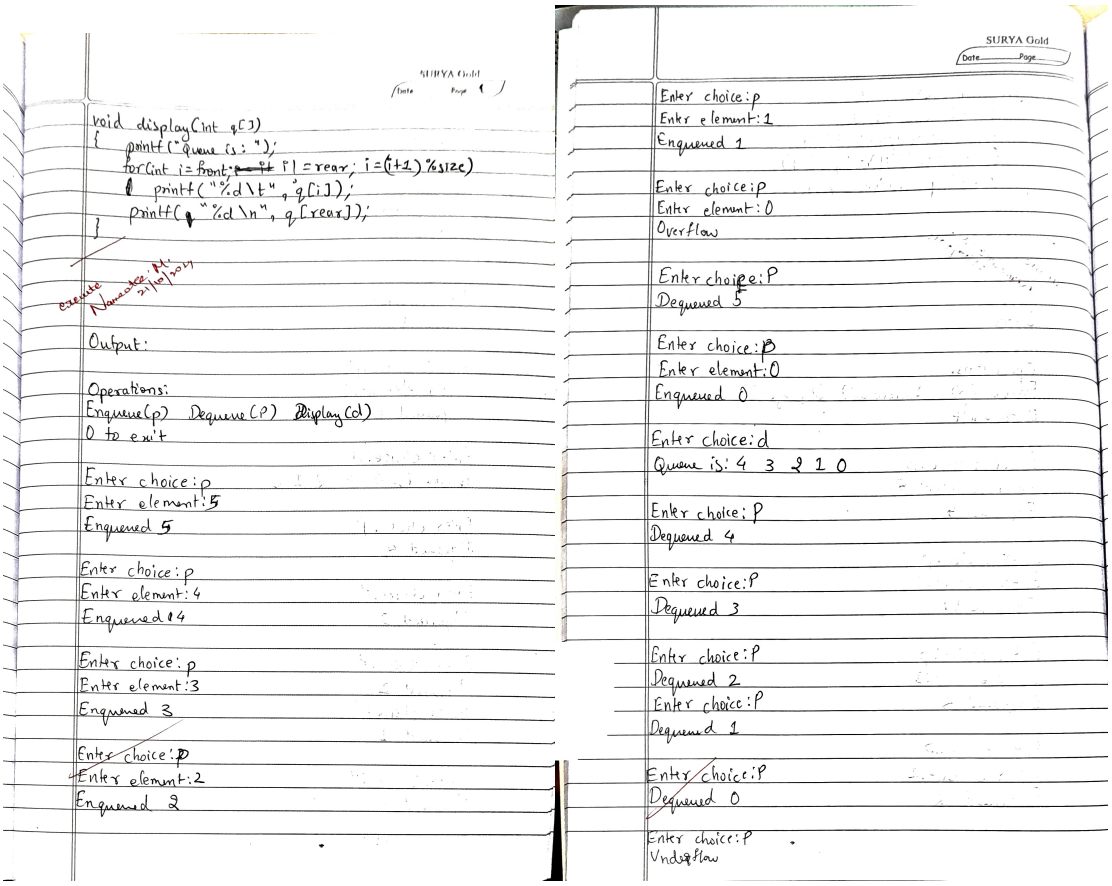
```
❯ ./queue

Operations:
Enqueue(p)          Dequeue(P)          Display(d)
0 to exit

Enter choice:p
Enter element:10

Enter choice:p
Enter element:9
Enqueued 9

Enter choice:p
Enter element:8
Enqueued 8

Enter choice:p
Enter element:7
Enqueued 7

Enter choice:p
Enter element:6
Enqueued 6

Enter choice:p
Enter element:5
Overflow

Enter choice:P
Dequeued 10

Enter choice:p
Enter element:6
Overflow

Enter choice:P
Dequeued 10

Enter choice:p
Enter element:6
Overflow

Enter choice:d
Queue as:10     9       8       7       6

Enter choice:P
Dequeued 9

Enter choice:P
Dequeued 8

Enter choice:P
Dequeued 7

Enter choice:P
Dequeued 6

Enter choice:P
Underflow

Enter choice:P
Underflow

Enter choice:0

Exiting...
```

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



```
⇒ Implement a circular queue.

#include <stdio.h>
#include <stdbool.h>
#define size 5
int front=-1, rear=-1;
int
bool isEmpty()
{
    return front == -1 && front == rear;
}
bool isFull()
{
    return (rear+1)%size == front;
}
void enqueue(int q[], int x)
{
    if(!isFull())
    {
        rear =(rear+1) %size;
        q[rear] = x;
        printf("Enqueued %d\n", q[rear]);
    }
    else if(isEmpty())
    {
        front = 0; rear = 0;
        q[rear] = x;
        printf("Enqueued %d\n", q[rear]);
    }
    else
    {
        printf("Overflow\n");
    }
}
```

```
int dequeue(int q[])
{
    if (!isEmpty())
    {
        front = (front+1)%size;
        return q[front];
    }
    else if(
    {
    }

int dequeue(int q[])
{
    if(isEmpty())
        printf("Underflow\n");
    else if(front == rear)
    {
        int temp=q[front];
        front = -1; rear = -1;
        return temp;
    }
    else
    {   int temp = q[front];
        front =(front+1)%size;
        return temp;
    }
}
```



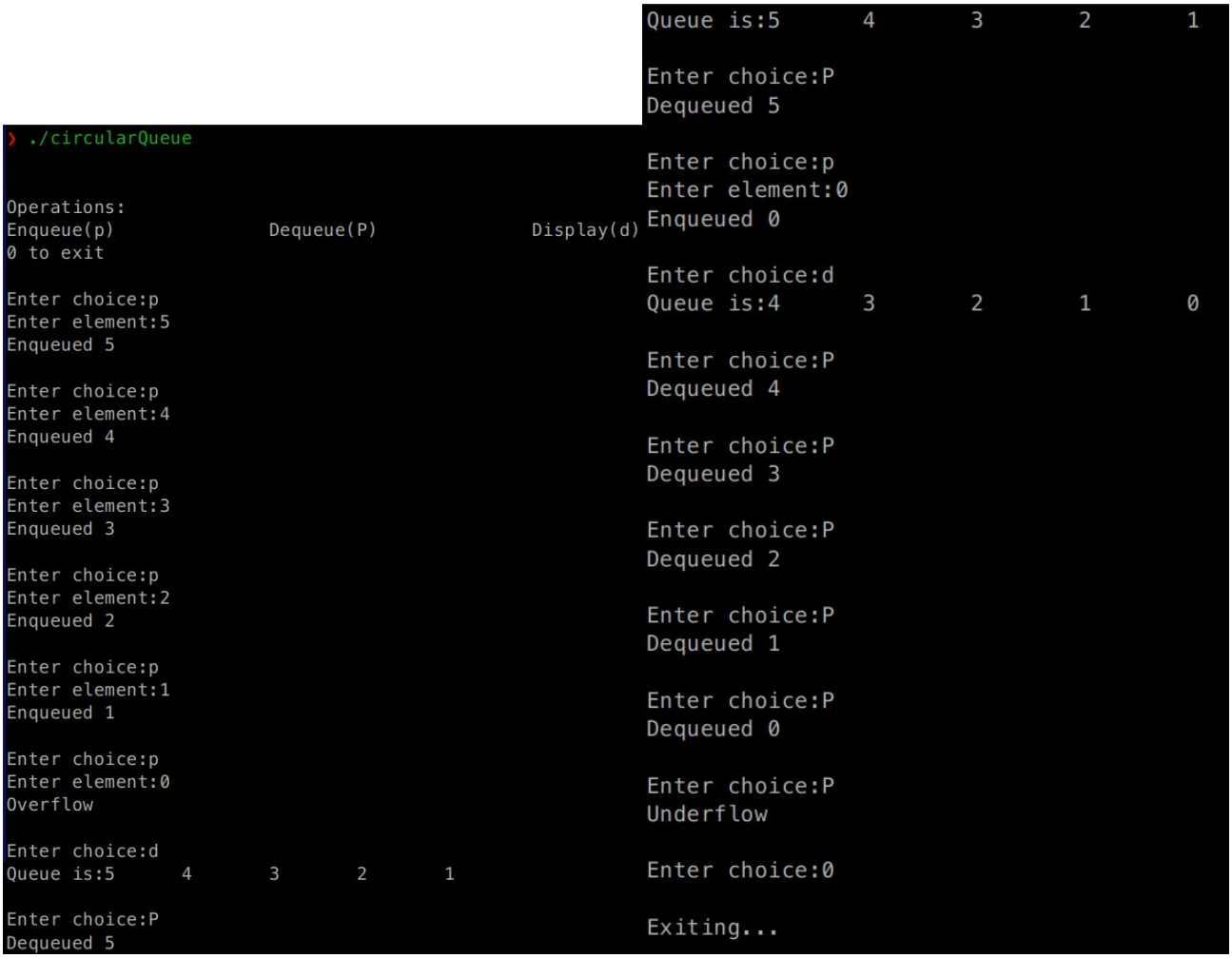
Code:

```
#include <stdio.h>
#include <stdbool.h>
#define size 5
int front=-1, rear=-1;
bool isEmpty(){return front==-1&rear==front;}
bool isFull(){return (rear+1)%size==front;}

void enqueue(int q[], int x)
{
	if(isEmpty())
	{
		front=0; rear=0;
		q[rear]=x;
		printf("Enqueued %d\n",q[rear]);
	}
	else if(!isFull())
	{
		rear=(rear+1)%size;
		q[rear]=x;
```

```
		printf("Enqueued %d\n",q[rear]);
	}
	else
	{
		printf("Overflow\n");
	}
}

int dequeue(int q[])
{
	if(isEmpty())
	{
		printf("Underflow\n");
	}
	else if(front==rear)
	{
		int temp=q[front];
		front=-1;rear=-1;
		return temp;
	}
	else
	{
		int temp=q[front];
		front=(front+1)%size;
		return temp;
	}
}
void display(int* q)
{
	printf("Queue is:");
	for(int i=front;i!=rear;i=(i+1)%size)
		printf("%d\t",q[i]);
	printf("%d\n",q[rear]);
}

void main()
{
	int q[size];
	char choice, c;
	printf("\n\nOperations:\n");
	printf("Enqueue(p)\t\tDequeue(P)\t\tDisplay(d)\n0 to exit\n");
	do{
		// TODO input here
		printf("\nEnter choice:");
		scanf("%c",&choice);
```

```
        switch(choice)
        {
                case 'p':int x;
                        printf("Enter element:");
                        scanf("%d",&x);
                        enqueue(q,x);
                        break;
                case 'P':if(isEmpty())
                                        printf("Underflow\n");
                                else
                                        printf("Dequeued %d\n",dequeue(q));
                                break;
                case 'd':display(q);
                        break;
                case '0': break;
                default: break;
        }
        // Flush stdin
        if((c=getchar())=='\n'||c==EOF){}
        }while(choice!='0');
        printf("\nExiting...\n");

}
```

OUTPUT


❯ ./circularQueue
Operations:
Enqueue(p) Dequeue(P) Display(d)
0 to exit
Enter choice:p
Enter element:5
Enqueued 5
Enter choice:p
Enter element:4
Enqueued 4
Enter choice:p
Enter element:3
Enqueued 3
Enter choice:p
Enter element:2
Enqueued 2
Enter choice:p
Enter element:1
Enqueued 1
Enter choice:p
Enter element:0
Overflow
Enter choice:d
Queue is:5 4 3 2 1
Enter choice:P
Dequeued 5
Queue is:5 4 3 2 1
Enter choice:P
Dequeued 5
Enter choice:p
Enter element:0
Enqueued 0
Enter choice:d
Queue is:4 3 2 1 0
Enter choice:P
Dequeued 4
Enter choice:P
Dequeued 3
Enter choice:P
Dequeued 2
Enter choice:P
Dequeued 1
Enter choice:P
Dequeued 0
Enter choice:P
Underflow
Enter choice:0
Exiting...

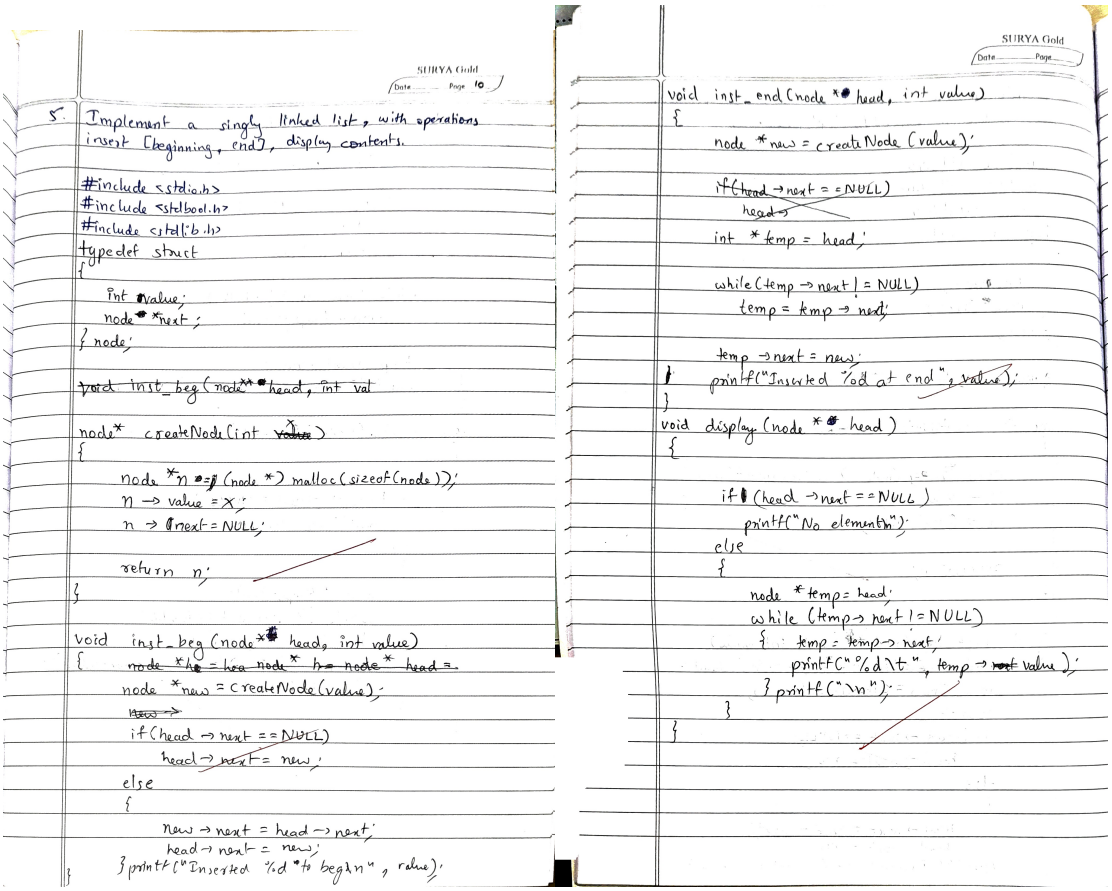
Problem 4:

WAP to Implement Singly Linked List with following operations:

a) Create a linked list.

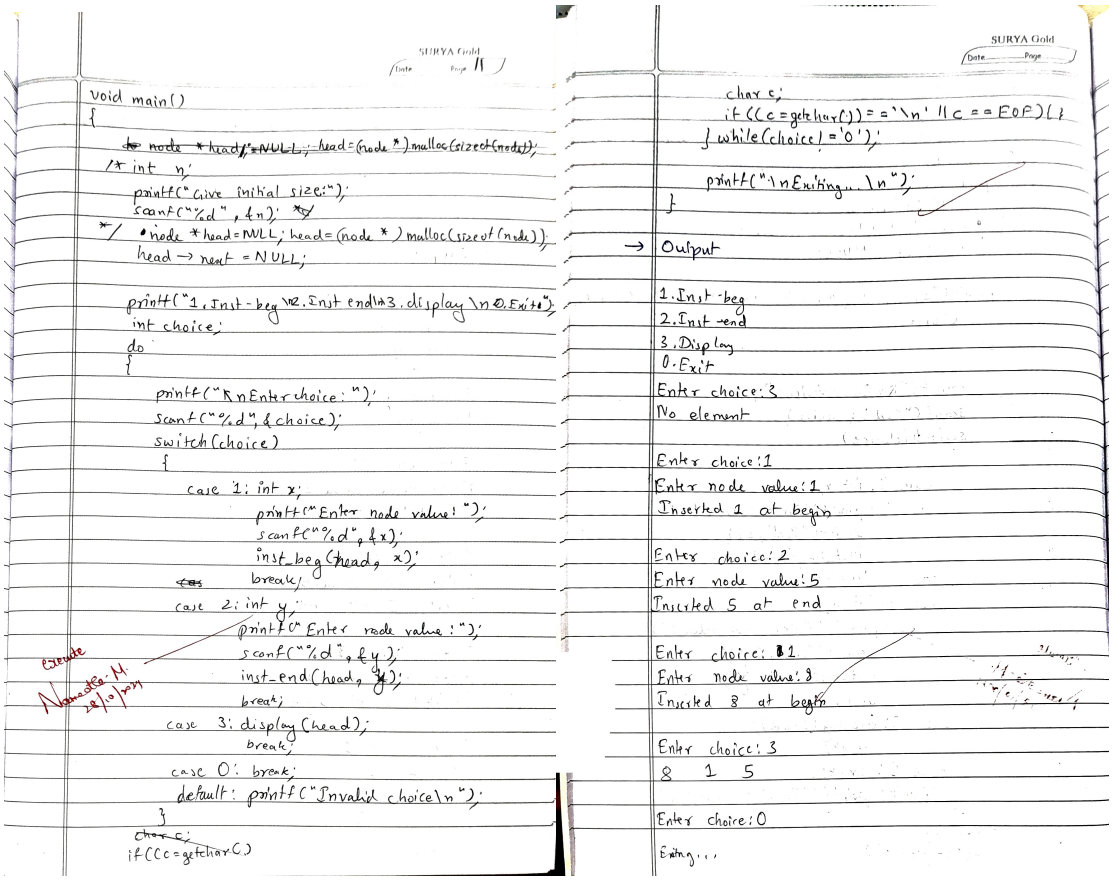
b) Insertion of a node at first position, at any position and at end of list.

Display the contents of the linked list.



```
5. Implement a singly linked list, with operations
insert (beginning, end), display contents.

#include <stdio.h>
#include <stdbool.h>
#include <stdlib.h>
typedef struct
{
    int value;
    node *next;
} node;

node* createNode(int x)
{
    node *n = (node *) malloc(sizeof(node));
    n -> value = x;
    n -> next = NULL;

    return n;
}

void inst_beg(node *head, int value)
{
    node *new = createNode(value);
    if(head -> next == NULL)
        head -> next = new;
    else
    {
        new -> next = head -> next;
        head -> next = new;
    } printf("Inserted %d at begin\n", value);
```

```
void inst_end(node *head, int value)
{
    node *new = createNode(value);

    if(head -> next == NULL)
        head->
    int *temp = head;

    while(temp -> next != NULL)
        temp = temp -> next;

    temp -> next = new;
    printf("Inserted %d at end", value);
}
void display(node *head)
{

    if(head -> next == NULL)
        printf("No elements");
    else
    {
        node *temp = head;
        while(temp -> next != NULL)
        { temp = temp -> next;
            printf("%d\t", temp -> value);
        } printf("\n");
    }
}
```



Code:

```
#include <stdio.h>
#include <stdbool.h>
#include <stdlib.h>
typedef struct node node;
struct node
{
	int value;
	struct node *next;
};

node* createNode(int x)
{
	node *n = (node*)malloc(sizeof(node));
	n->value=x;
	n->next=NULL;

	return n;
}
```

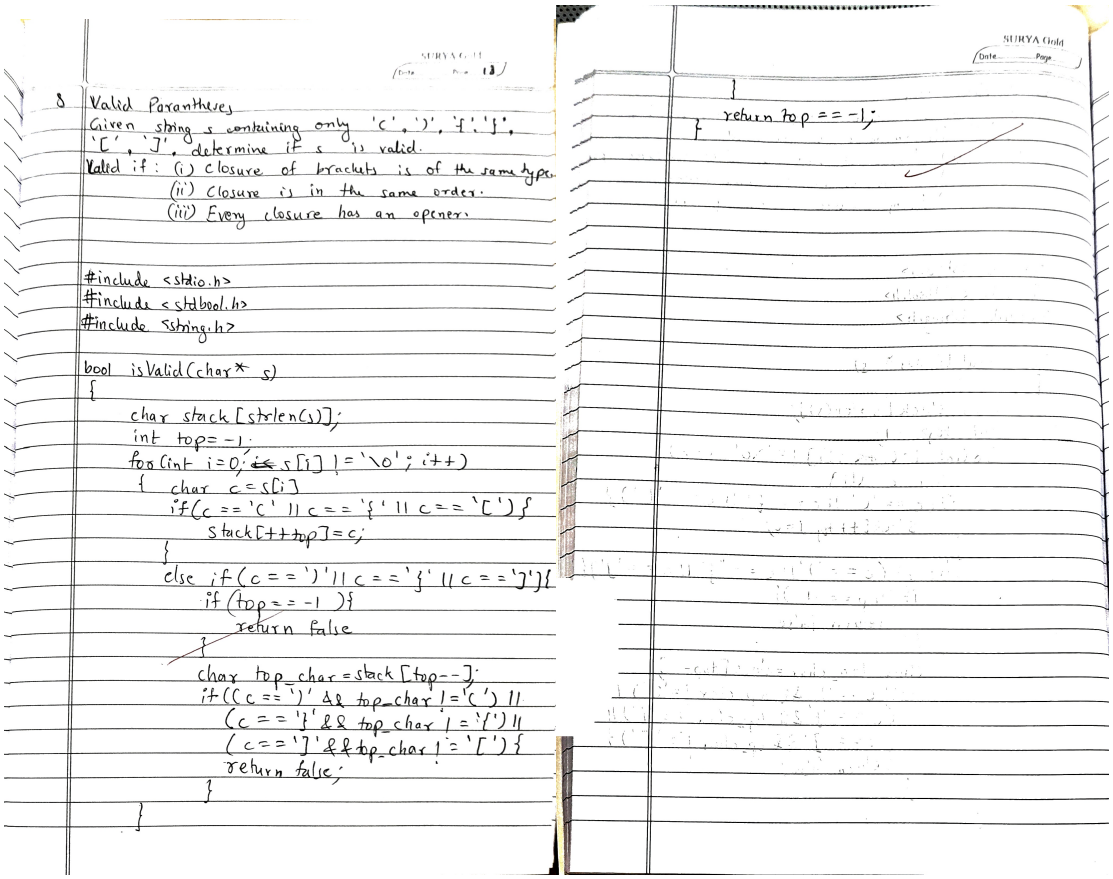
```
void inst_beg(node* head, int value)
{
	node *new = createNode(value);

	if(head->next == NULL)
		head->next = new;
	else
	{
		new->next = head->next;
		head->next = new;
	}
	printf("Inserted %d at begin\n",value);
}

void inst_end(node* head, int value)
{
	node *new = createNode(value);

	node *temp = head;

	while(temp->next!=NULL)
		temp = temp->next;

	temp->next = new;
	printf("Inserted %d at end\n",value);
}

void display(node* head)
{
	node *temp= head;
	if(head->next==NULL){
		printf("No element\n");
		return;
	}
	while(temp->next!=NULL)
	{
		temp = temp->next;
		printf("%d\t",temp->value);
	}
	printf("\n");
}

void main()
{
	node *head=NULL;
```

```
        head = (node *) malloc(sizeof(node));
        head->next = NULL;

        printf("1.Inst-beg\n2.Inst-end\n3.Display\n0.Exit");
        int choice;
        char c;
        do
        {
                printf("\nEnter choice:");
                scanf("%d",&choice);

                switch(choice)
                {
                        case 1:int x;
                                printf("Enter node value:");
                                scanf("%d",&x);
                                inst_beg(head,x);
                                break;
                        case 2:int y;
                               printf("Enter node value:");
                               scanf("%d",&y);
                               inst_end(head,y);
                                break;
                        case 3:display(head);
                                break;
                        case 0:break;
                        default:printf("Invalid choice\n");
                }
                if((c=getchar())=='\n'||c==EOF){}
        }while(choice!=0);
        printf("\nExiting...\n");
}
```

OUTPUT

```
❯ ./linkedList
1.Inst-beg
2.Inst-end
3.Display
0.Exit
Enter choice:1
Enter node value:1
Inserted 1 at begin

Enter choice:2
Enter node value:5
Inserted 5 at end

Enter choice:1
Enter node value:8
Inserted 8 at begin

Enter choice:3
8       1       5

Enter choice:0

Exiting...
```

Program - Leetcode platform – Valid Parantheses

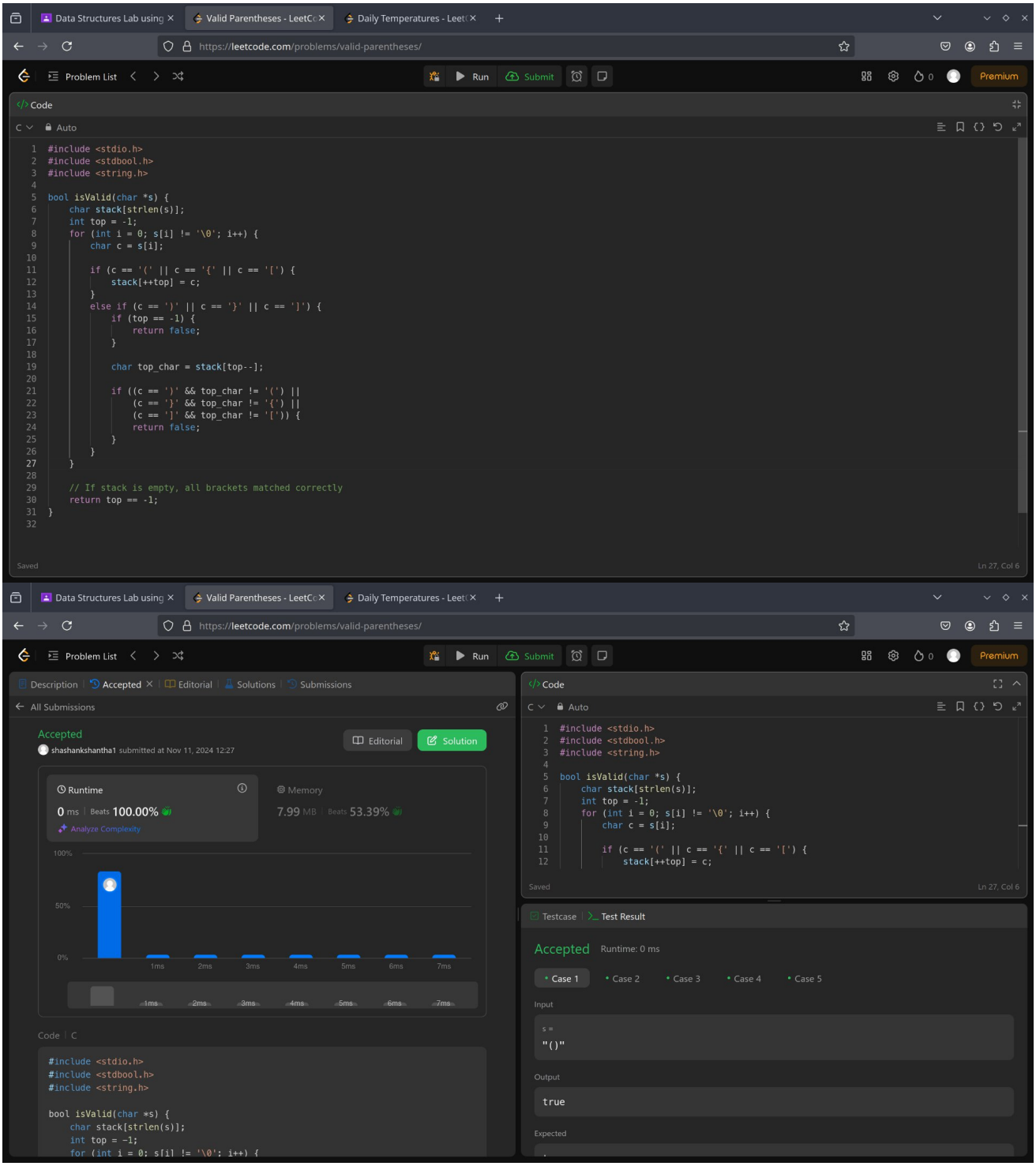


8 Valid Paranthesis
Given string s containing only '(', ')', '{', '}', '[', ']', determine if s is valid.
Valid if: (i) closure of brackets is of the same type.
(ii) closure is in the same order.
(iii) Every closure has an opener.

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

bool isValid(char* s)
{
    char stack[strlen(s)];
    int top=-1;
    for(int i=0; s[i] != '\0'; i++)
    {   char c=s[i];
        if(c == '(' || c == '{' || c == '['){
            stack[++top]=c;
        }
        else if(c == ')' || c == '}' || c == ']'){
            if (top == -1 ){
                return false
            }
            char top_char=stack[top--];
            if((c == ')' && top_char != '(') ||
               (c == '}' && top_char != '{') ||
               (c == ']' && top_char != '[') {
                return false;
            }
    }
```

```
    return top == -1;
}
```

OUTPUT


Data Structures Lab using
Valid Parentheses - LeetCo
Daily Temperatures - Leet
https://leetcode.com/problems/valid-parentheses/
Problem List
Run
Submit
Premium
Code
Auto
#include <stdio.h>
#include <stdbool.h>
#include <string.h>
bool isValid(char *s) {
char stack[strlen(s)];
int top = -1;
for (int i = 0; s[i] != '\0'; i++) {
char c = s[i];
if (c == '(' || c == '{' || c == '[') {
stack[++top] = c;
}
else if (c == ')' || c == '}' || c == ']') {
if (top == -1) {
return false;
}
char top_char = stack[top--];
if ((c == ')' && top_char != '(') ||
(c == '}' && top_char != '{') ||
(c == ']' && top_char != '[')) {
return false;
}
}
}
// If stack is empty, all brackets matched correctly
return top == -1;
}
Saved
Ln 27, Col 6
Description
Accepted
Editorial
Solutions
Submissions
All Submissions
Accepted
shashankshantha1 submitted at Nov 11, 2024 12:27
Editorial
Solution
Runtime
0 ms | Beats 100.00%
Analyze Complexity
Memory
7.99 MB | Beats 53.39%
100%
50%
0%
1ms
2ms
3ms
4ms
5ms
6ms
7ms
Code | C
Testcase
Test Result
Accepted
Runtime: 0 ms
Case 1
Case 2
Case 3
Case 4
Case 5
Input
s =
"()"
Output
true
Expected

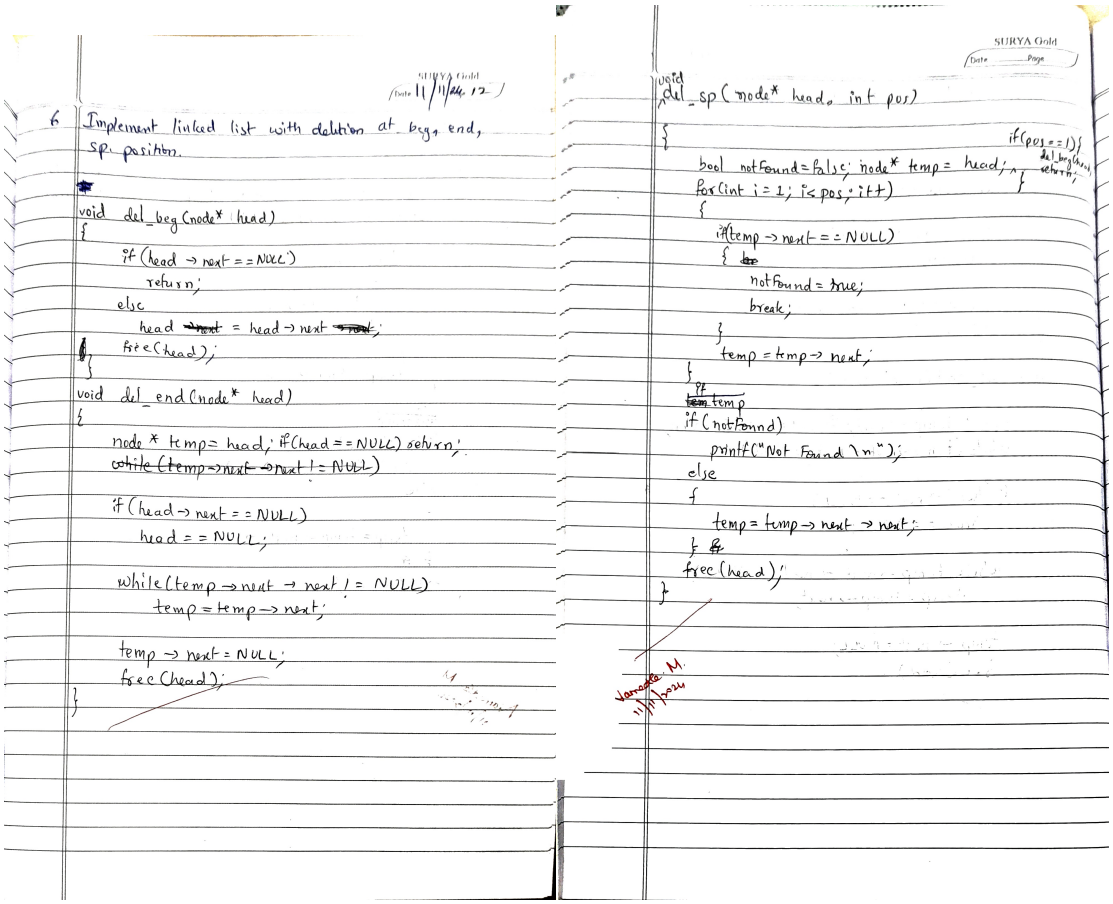
Program 5:

WAP to Implement Singly Linked List with following operations:

a) Create a linked list.

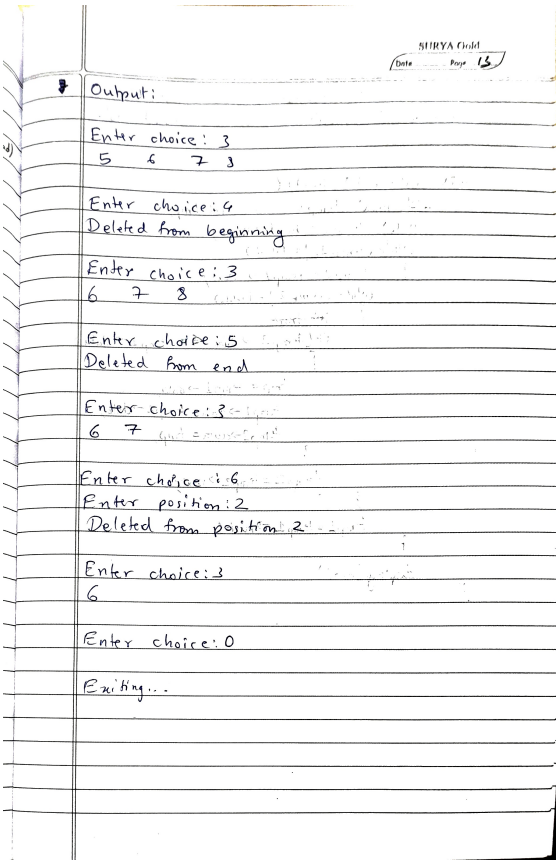
b) Deletion of first element, specified element and last element in the list.

c) Display the contents of the linked list.



```
6 Implement linked list with deletion at beg, end, sp. position.

void del_beg(node* head)
{
    if(head->next==NULL)
        return;
    else
        head = head->next;
    free(head);
}
void del_end(node* head)
{
    node *temp=head; if(head==NULL) return;
    while(temp->next->next!=NULL)

    if(head->next==NULL)
        head==NULL;

    while(temp->next->next!=NULL)
        temp=temp->next;

    temp->next=NULL;
    free(head);
}
```

```
void del_sp(node* head, int pos)
{
    bool notfound=false; node* temp=head;
    for(int i=1; i<pos; i++)
    {
        if(temp->next==NULL)
        {
            notfound=true;
            break;
        }
        temp=temp->next;
    }
    if(notfound)
        printf("Not Found\n");
    else
    {
        temp=temp->next->next;
    }
    free(head);
}
```



Code:

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

typedef struct node node;
struct node {
    int value;
    struct node *next;
};

node* createNode(int x) {
    node *n = (node*)malloc(sizeof(node));
    n->value = x;
    n->next = NULL;
    return n;
}

void inst_beg(node* head, int value) {
    node *new = createNode(value);
    new->next = head->next;
```

```
    head->next = new;
    printf("Inserted %d at begin\n", value);
}

void inst_end(node* head, int value) {
    node *new = createNode(value);
    node *temp = head;
    while (temp->next != NULL) {
        temp = temp->next;
    }
    temp->next = new;
    printf("Inserted %d at end\n", value);
}

void display(node* head) {
    node *temp = head->next;
    if (temp == NULL) {
        printf("No element\n");
        return;
    }
    while (temp != NULL) {
        printf("%d\t", temp->value);
        temp = temp->next;
    }
    printf("\n");
}

void del_beg(node* head) {
    if (head == NULL || head->next == NULL) {
        return;
    }
    node* temp = head->next;
    head->next = temp->next;
    free(temp);
    printf("Deleted from the beginning\n");
}

void del_end(node* head) {
    if (head == NULL || head->next == NULL) {
        return;
    }
    node* temp = head;
    while (temp->next != NULL && temp->next->next != NULL) {
        temp = temp->next;
    }
```

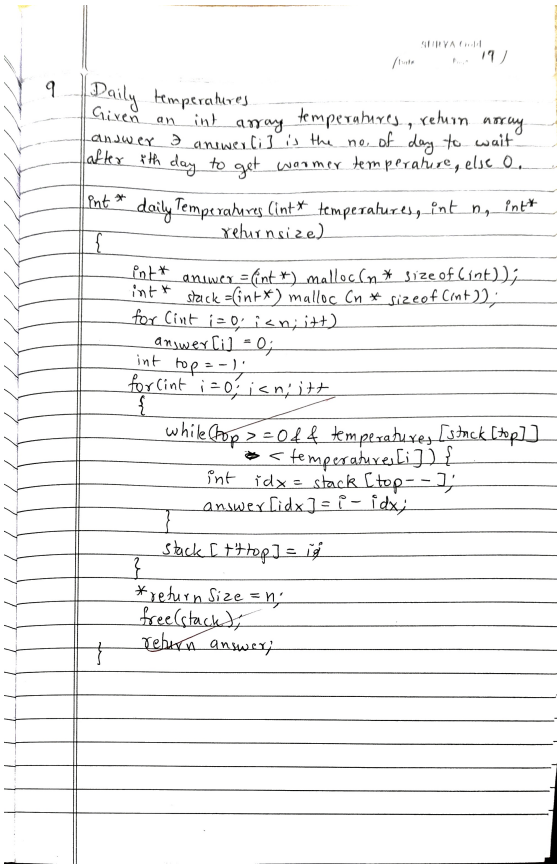
```
    node* toDelete = temp->next;
    temp->next = NULL;
    free(toDelete);
    printf("Deleted from the end\n");
}

void del_sp(node* head, int pos) {
    if (head == NULL || head->next == NULL) {
        printf("List is empty\n");
        return;
    }

    node* temp = head;
    for (int i = 1; i < pos; i++) {
        if (temp->next == NULL) {
            printf("Position not found\n");
            return;
        }
        temp = temp->next;
    }

    node* toDelete = temp->next;
    if (toDelete != NULL) {
        temp->next = toDelete->next;
        free(toDelete);
        printf("Deleted from position %d\n", pos);
    }
}

int main() {
    node *head = (node *)malloc(sizeof(node));
    head->next = NULL;

    printf("1. Inst-beg\n2. Inst-end\n3. Display\n4. Del-beg\n5. Del-end\n6. Del-sp\n0. Exit\n");

    int choice;
    char c;
    do {
        printf("\nEnter choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1: {
                int x;
                printf("Enter node value: ");
```

```
            scanf("%d", &x);
            inst_beg(head, x);
            break;
        }
        case 2: {
            int y;
            printf("Enter node value: ");
            scanf("%d", &y);
            inst_end(head, y);
            break;
        }
        case 3:
            display(head);
            break;
        case 4:
            del_beg(head);
            break;
        case 5:
            del_end(head);
            break;
        case 6: {
            int pos;
            printf("Enter position: ");
            scanf("%d", &pos);
            del_sp(head, pos);
            break;
        }
        case 0:
            break;
        default:
            printf("Invalid choice\n");
    }

    if ((c = getchar()) == '\n' || c == EOF) {}

  } while (choice != 0);

  printf("\nExiting...\n");
  return 0;
}
```

OUTPUT

```
❯ gcc linkedList.c -o linkedList
❯ ./linkedList
1. Inst-beg
2. Inst-end
3. Display
4. Del-beg
5. Del-end
6. Del-sp
0. Exit

Enter choice: 1
Enter node value: 5
Inserted 5 at begin

Enter choice: 2
Enter node value: 6
Inserted 6 at end

Enter choice: 2
Enter node value: 7
Inserted 7 at end

Enter choice: 2
Enter node value: 8
Inserted 8 at end

Enter choice: 3
5       6       7       8

Enter choice: 3
5       6       7       8

Enter choice: 4
Deleted from the beginning

Enter choice: 3
5       6       7       8

Enter choice: 4
Deleted from the beginning

Enter choice: 3
6       7       8

Enter choice: 5
Deleted from the end

Enter choice: 6
Enter position: 2
Deleted from position 2

Enter choice: 3
6

Enter choice: 0

Exiting...
```

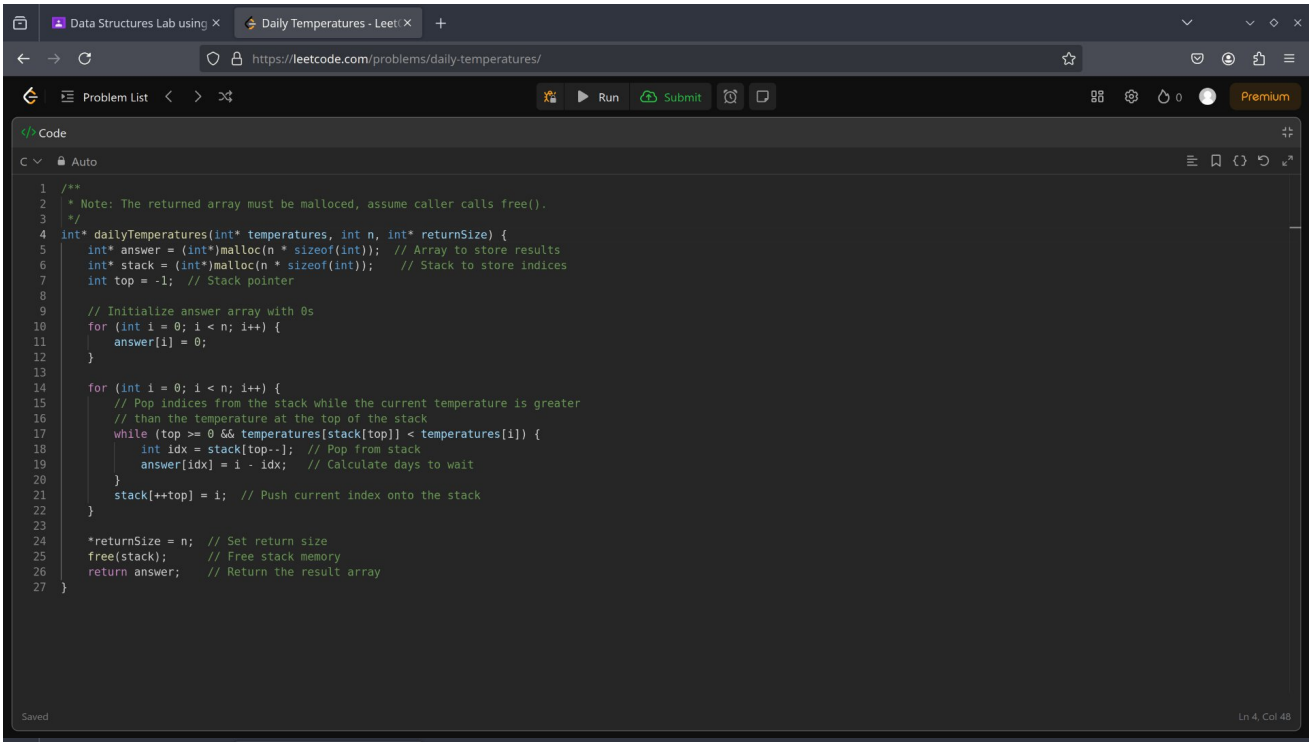
Program – LeetCode Question – Daily Temperatures

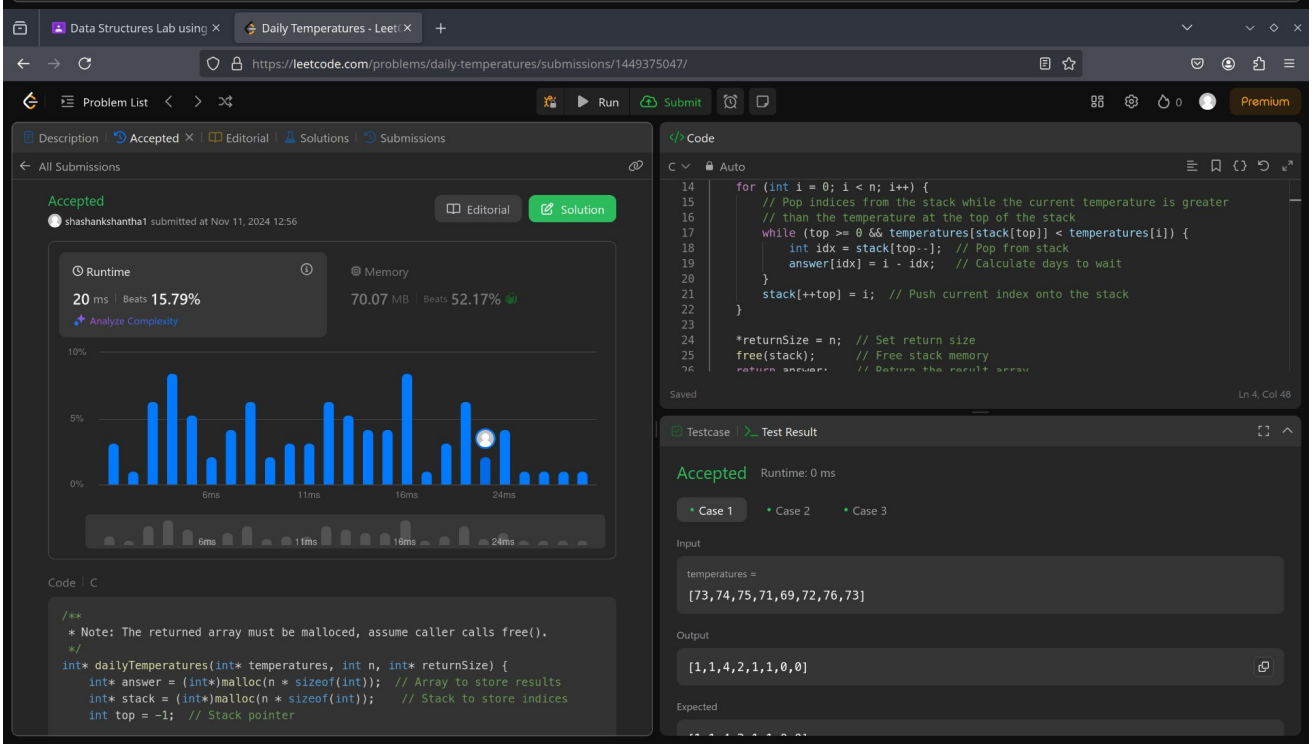


9 Daily temperatures
Given an int array temperatures, return array answer s answer[i] is the no. of day to wait after ith day to get warmer temperature, else 0.

```
int* dailyTemperatures(int* temperatures, int n, int*
        returnSize)
{
    int* answer = (int*) malloc(n * sizeof(int));
    int* stack = (int*) malloc (n * sizeof(int));
    for (int i=0; i<n; i++)
      answer[i] = 0;
    int top = -1;
    for(int i=0; i<n; i++
    {
      while(top >= 0 && temperatures[stack[top]]
            < temperatures[i]) {
        int idx = stack[top--];
        answer[idx] = i - idx;
      }
      stack[++top] = i;
    }
    *returnSize = n;
    free(stack);
    return answer;
}
```

OUTPUT


Data Structures Lab using
Daily Temperatures - Leet
https://leetcode.com/problems/daily-temperatures/
Problem List
Run
Submit
Premium
Code
Auto
/**
* Note: The returned array must be malloced, assume caller calls free().
*/
int* dailyTemperatures(int* temperatures, int n, int* returnSize) {
int* answer = (int*)malloc(n * sizeof(int)); // Array to store results
int* stack = (int*)malloc(n * sizeof(int)); // Stack to store indices
int top = -1; // Stack pointer
// Initialize answer array with 0s
for (int i = 0; i < n; i++) {
answer[i] = 0;
}
for (int i = 0; i < n; i++) {
// Pop indices from the stack while the current temperature is greater
// than the temperature at the top of the stack
while (top >= 0 && temperatures[stack[top]] < temperatures[i]) {
int idx = stack[top--]; // Pop from stack
answer[idx] = i - idx; // Calculate days to wait
}
stack[++top] = i; // Push current index onto the stack
}
*returnSize = n; // Set return size
free(stack); // Free stack memory
return answer; // Return the result array
}
Saved
Ln 4, Col 48


Data Structures Lab using
Daily Temperatures - Leet
https://leetcode.com/problems/daily-temperatures/submissions/1449375047/
Problem List
Run
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Premium
Description
Accepted
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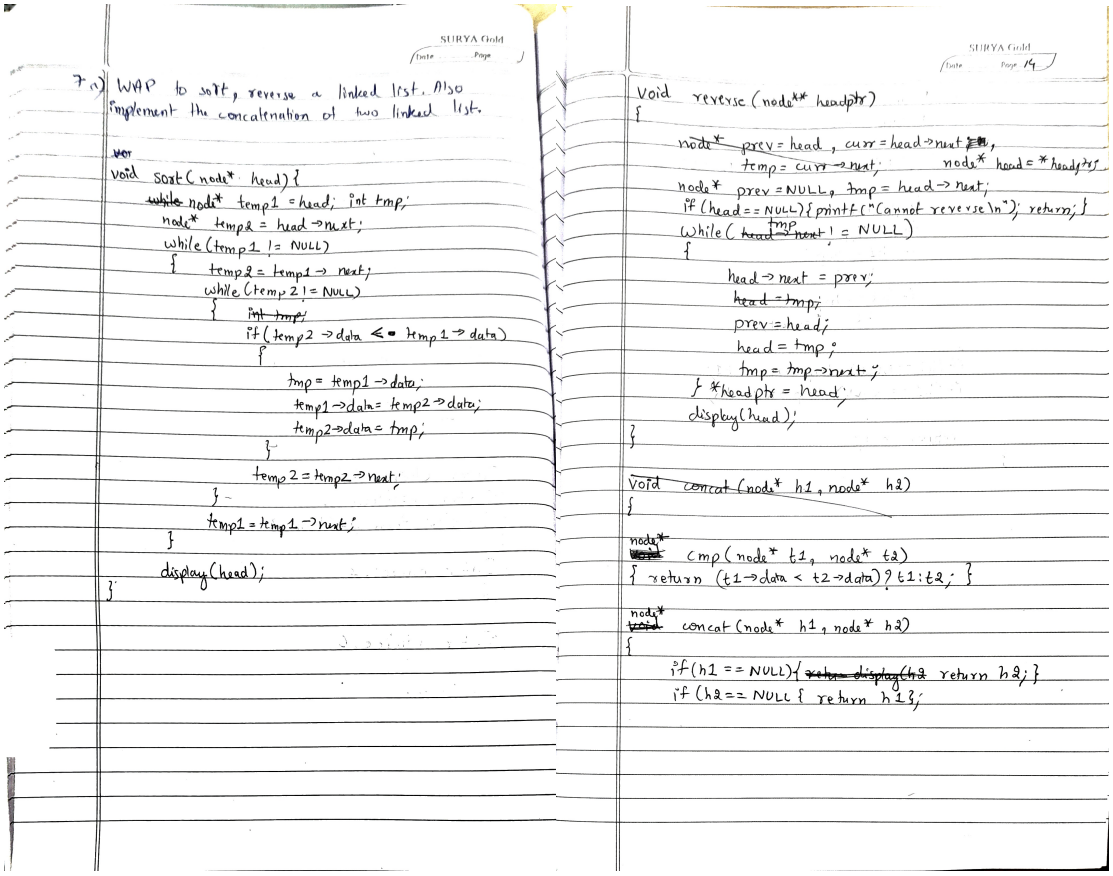
Accepted
shashankshantha1 submitted at Nov 11, 2024 12:56
Editorial
Solution
Runtime
20 ms | Beats 15.79%
Analyze Complexity
Memory
70.07 MB | Beats 52.17%
10%
5%
0%
6ms
11ms
16ms
24ms
Code | C
/**
* Note: The returned array must be malloced, assume caller calls free().
*/
int* dailyTemperatures(int* temperatures, int n, int* returnSize) {
int* answer = (int*)malloc(n * sizeof(int)); // Array to store results
int* stack = (int*)malloc(n * sizeof(int)); // Stack to store indices
int top = -1; // Stack pointer
Code
Auto
for (int i = 0; i < n; i++) {
// Pop indices from the stack while the current temperature is greater
// than the temperature at the top of the stack
while (top >= 0 && temperatures[stack[top]] < temperatures[i]) {
int idx = stack[top--]; // Pop from stack
answer[idx] = i - idx; // Calculate days to wait
}
stack[++top] = i; // Push current index onto the stack
}
*returnSize = n; // Set return size
free(stack); // Free stack memory
Saved
Ln 4, Col 48
Testcase
Test Result
Accepted
Runtime: 0 ms
Case 1
Case 2
Case 3
Input
temperatures =
[73,74,75,71,69,72,76,73]
Output
[1,1,4,2,1,1,0,0]
Expected

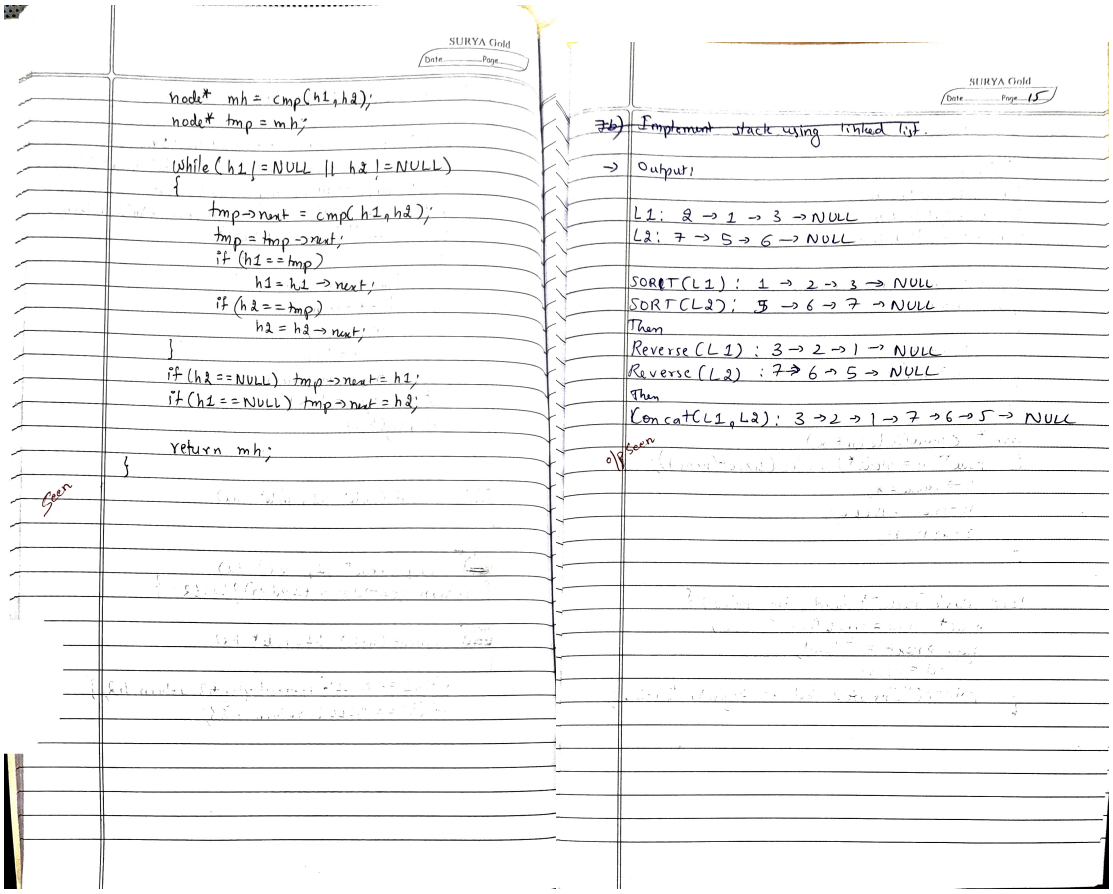
Program 6:

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



```
7a) WAP to sort, reverse a linked list. Also
implement the concatenation of two linked list.

void sort(node* head){
  node* temp1 = head; int tmp;
  node* temp2 = head->next;
  while(temp1 != NULL)
  {
    temp2 = temp1->next;
    while(temp2 != NULL)
    {
      if(temp2->data <= temp1->data)
      {
        tmp = temp1->data;
        temp1->data = temp2->data;
        temp2->data = tmp;
      }
      temp2 = temp2->next;
    }
    temp1 = temp1->next;
  }
  display(head);
}
```

```
void reverse(node** headptr)
{
  node* prev = head, curr = head->next,
        temp = curr->next;   node* head = *headptr
  node* prev = NULL, tmp = head->next;
  if(head == NULL){printf("cannot reverse\n"); return;}
  while(tmp != NULL)
  {
    head->next = prev;
    head = tmp;
    prev = head;
    head = tmp;
    tmp = tmp->next;
  } *headptr = head;
  display(head);
}

void concat(node* h1, node* h2)
{

node*
  cmp(node* t1, node* t2)
{ return (t1->data < t2->data)? t1:t2; }

node*
  concat(node* h1, node* h2)
{
  if(h1 == NULL){ return h2; }
  if(h2 == NULL { return h1;
```



Code:

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

typedef struct node node;
struct node {
    int value;
    node* next;
};

node* createNode(int x) {
    node* n = (node*)malloc(sizeof(node));
    n->value = x;
    n->next = NULL;
    return n;
}

void inst_beg(node** head, int value) {
    node *new = createNode(value);
```

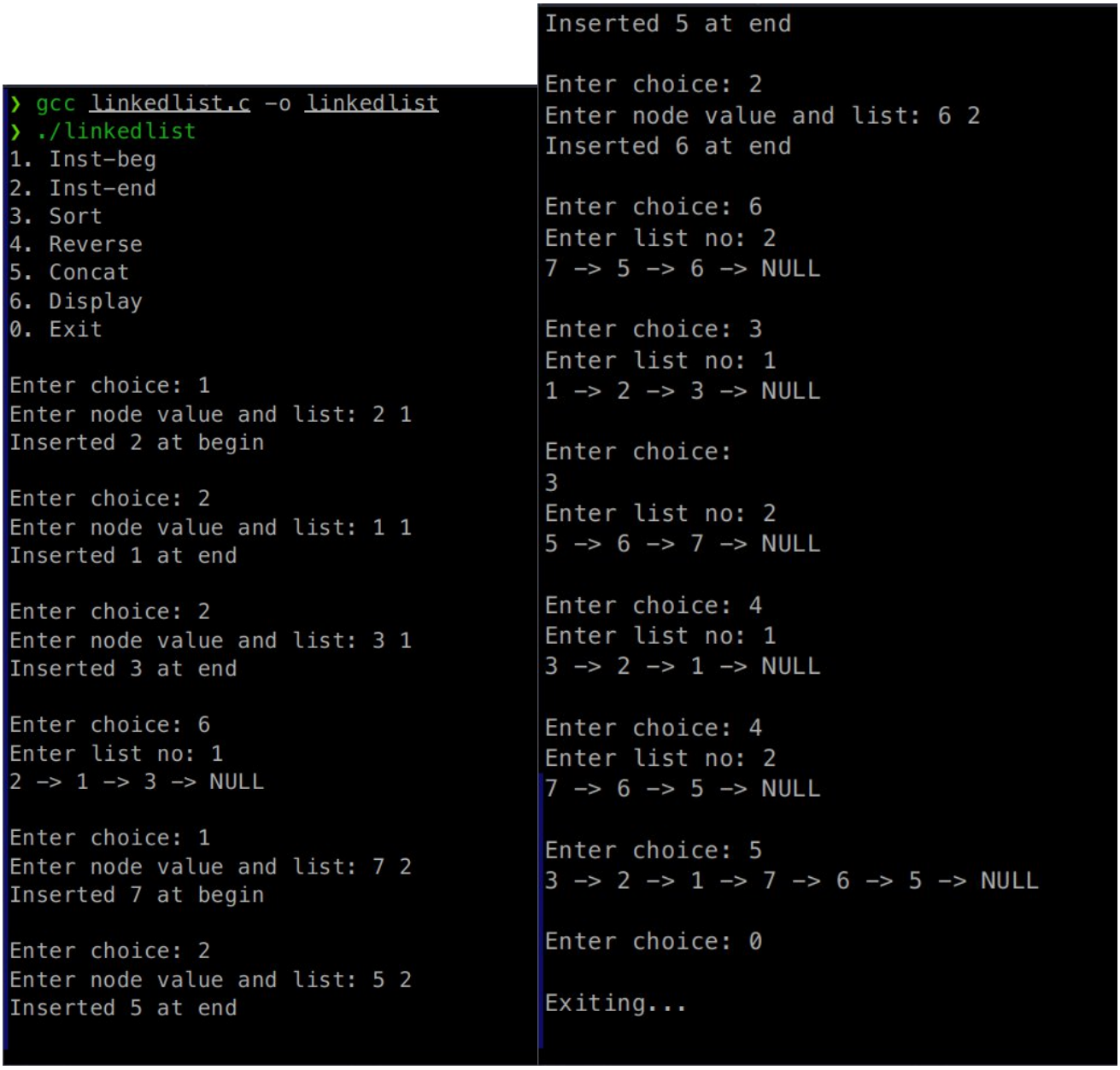
```
    new->next = *head;
    *head = new;
    printf("Inserted %d at begin\n", value);
}

void inst_end(node* head, int value) {
    node* new = createNode(value);
    node* temp = head;
    while (temp->next != NULL) {
        temp = temp->next;
    }
    temp->next = new;
    printf("Inserted %d at end\n", value);
}

void display(node* head) {
    node *temp = head;
    if (temp == NULL) {
        printf("No element\n");
        return;
    }
    while (temp != NULL) {
        printf("%d -> ", temp->value);
        temp = temp->next;
    }
    printf("NULL\n");
}


void sort(node* head)
{
        if (head == NULL) return;
        node* temp1 = head;
        while (temp1 != NULL)
        {
                node* temp2 = temp1->next;
                while (temp2 != NULL)
                {
                        if (temp2->value < temp1->value)
                        {
                                int tmp = temp1->value;
                                temp1->value = temp2->value;
                                temp2->value = tmp;
                        }
                        temp2 = temp2->next;
```

```
            }
            temp1 = temp1->next;
        }
        display(head);
}


void reverse(node** headptr)
{
        node* head = *headptr;
        node* prev = NULL;
        node* tmp = head ? head->next : NULL;

        while (tmp != NULL)
        {
            head->next = prev;
            prev = head;
            head = tmp;
            tmp = tmp->next;
        }
        head->next = prev; // Don't forget to point the new tail to NULL
        *headptr = head;
        display(head);
}


node* concat(node* h1, node* h2) {
    if (h1 == NULL) return h2;
    if (h2 == NULL) return h1;

    node* mh = NULL;
    node* tmp = NULL;

    // Initializing the head of the merged list by comparing the first nodes
    if (h1->value < h2->value) {
        mh = h1;
        h1 = h1->next;
    } else {
        mh = h2;
        h2 = h2->next;
    }

    tmp = mh; // set tmp to the head of the merged list

    // Merging the two lists
```

```
    while (h1 != NULL && h2 != NULL) {
        if (h1->value < h2->value) {
            tmp->next = h1;
            h1 = h1->next;
        } else {
            tmp->next = h2;
            h2 = h2->next;
        }
        tmp = tmp->next; // Move tmp to the last node
    }

    // If one of the lists is not empty, append the rest of the remaining list
    if (h1 != NULL) {
        tmp->next = h1;
    } else {
        tmp->next = h2;
    }

    // Display the merged list
    display(mh);

    return mh;
}

int main() {
    node* h1 = NULL;
    node* h2 = NULL;
    printf("1. Inst-beg\n2. Inst-end\n3. Sort\n4. Reverse\n5. Concat\n6. Display\n0. Exit\n");

    int choice;
    char c;
    do {
        printf("\nEnter choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1: {
                int x,y;
                printf("Enter node value and list: ");
                scanf("%d%d", &x, &y);
                (y==1)?inst_beg(&h1, x):inst_beg(&h2,x);
                break;
            }
            case 2: {
                int x,y;
```

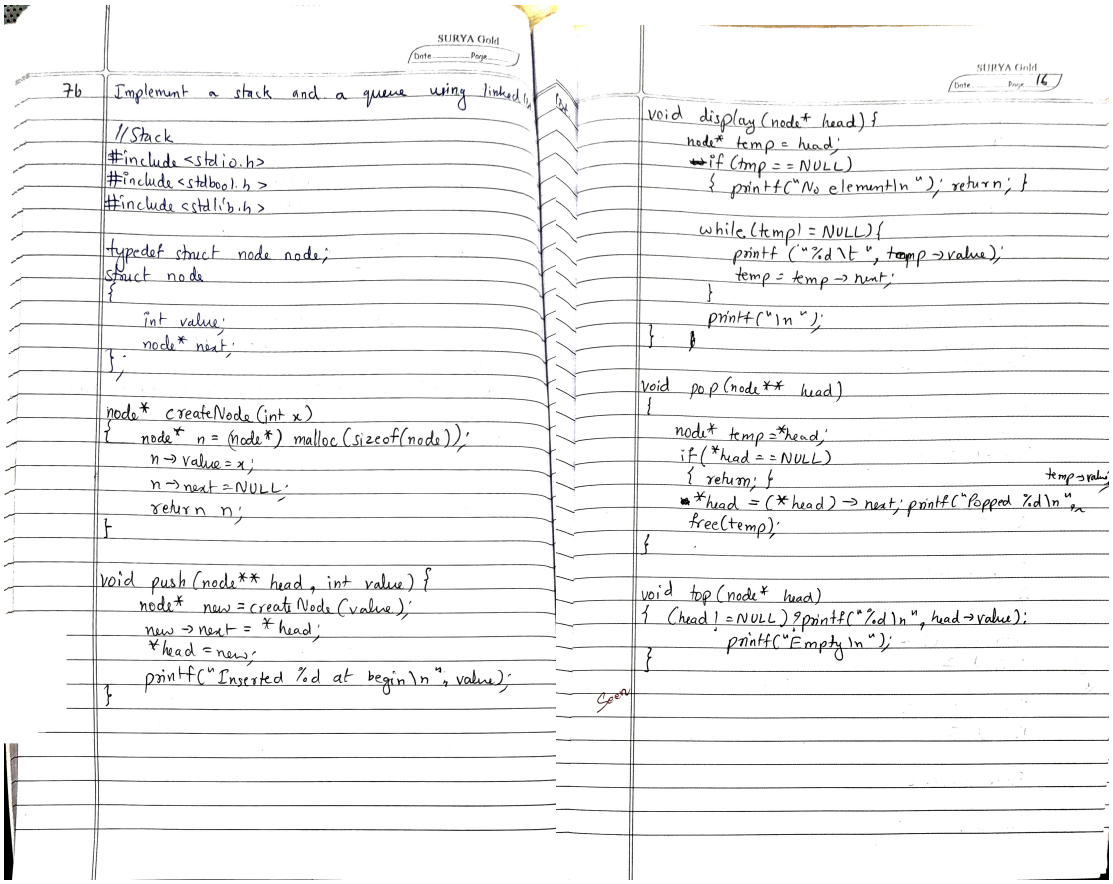
```
            printf("Enter node value and list: ");
            scanf("%d%d", &x, &y);
            (y==1)?inst_end(h1, x):inst_end(h2,x);
                break;
        }
        case 3:{
                int y;
            printf("Enter list no: ");
                scanf("%d",&y);
            sort((y==1)?h1:h2);
            break;
                }
        case 4:{
            int y;
            printf("Enter list no: ");
                scanf("%d",&y);
            reverse((y==1)?&h1:&h2);
            break;
                  }
        case 5:
            node* newList = concat(h1,h2);
            break;
        case 6: {
                int y;
            printf("Enter list no: ");
                scanf("%d", &y);
                display((y==1)?h1:h2);
                break;
                   }
        case 0:
            break;
        default:
            printf("Invalid choice\n");
      }

      if ((c = getchar()) == '\n' || c == EOF) {}

   } while (choice != 0);

   printf("\nExiting...\n");
   return 0;
}
```

OUTPUT



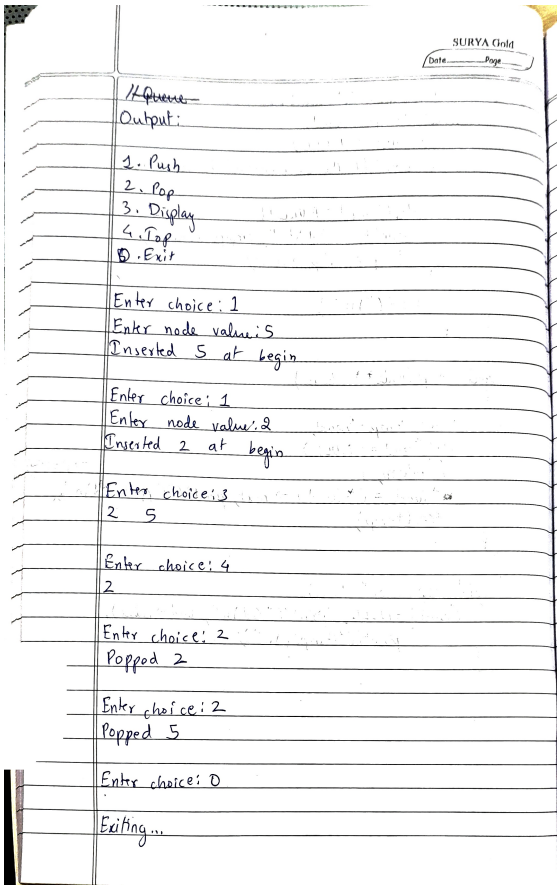
```
❯ gcc linkedlist.c -o linkedlist
❯ ./linkedlist
1. Inst-beg
2. Inst-end
3. Sort
4. Reverse
5. Concat
6. Display
0. Exit

Enter choice: 1
Enter node value and list: 2 1
Inserted 2 at begin

Enter choice: 2
Enter node value and list: 1 1
Inserted 1 at end

Enter choice: 2
Enter node value and list: 3 1
Inserted 3 at end

Enter choice: 6
Enter list no: 1
2 -> 1 -> 3 -> NULL

Enter choice: 1
Enter node value and list: 7 2
Inserted 7 at begin

Enter choice: 2
Enter node value and list: 5 2
Inserted 5 at end

Inserted 5 at end

Enter choice: 2
Enter node value and list: 6 2
Inserted 6 at end

Enter choice: 6
Enter list no: 2
7 -> 5 -> 6 -> NULL

Enter choice: 3
Enter list no: 1
1 -> 2 -> 3 -> NULL

Enter choice:
3
Enter list no: 2
5 -> 6 -> 7 -> NULL

Enter choice: 4
Enter list no: 1
3 -> 2 -> 1 -> NULL

Enter choice: 4
Enter list no: 2
7 -> 6 -> 5 -> NULL

Enter choice: 5
3 -> 2 -> 1 -> 7 -> 6 -> 5 -> NULL

Enter choice: 0

Exiting...
```

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



```
7b  Implement a stack and a queue using linked list

//Stack
#include <stdio.h>
#include <stdbool.h>
#include <stdlib.h>

typedef struct node node;
struct node
{
    int value;
    node* next;
};

node* createNode(int x)
{
    node* n = (node*) malloc(sizeof(node));
    n->value = x;
    n->next = NULL;
    return n;
}

void push(node** head, int value) {
    node* new = createNode(value);
    new->next = *head;
    *head = new;
    printf("Inserted %d at begin\n", value);
}
```

```
void display(node* head) {
    node* temp = head;
    if (temp == NULL)
    { printf("No element\n"); return; }

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

void pop(node** head)
{
    node* temp = *head;
    if(*head == NULL)
    { return; }
    *head = (*head)->next; printf("Popped %d\n", temp->value);
    free(temp);
}

void top(node* head)
{ (head != NULL) ? printf("%d\n", head->value);
        printf("Empty\n");
}
```



Code for Stack:

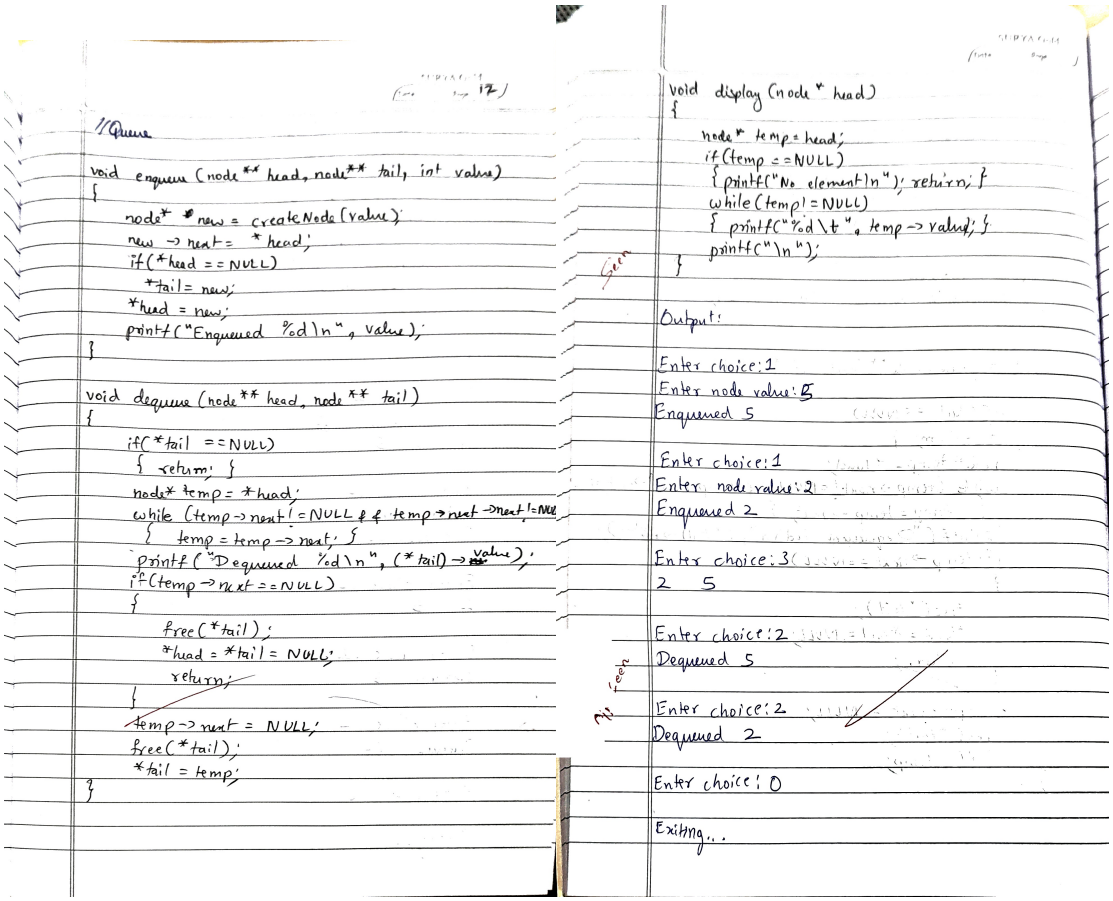
```
#include <stdio.h>
#include <stdbool.h>
#include <stdlib.h>

typedef struct node node;
struct node {
    int value;
    node* next;
};

node* createNode(int x) {
    node *n = (node*)malloc(sizeof(node));
    n->value = x;
    n->next = NULL;
    return n;
}

void push(node** head, int value) {
    node *new = createNode(value);
```

```
    new->next = *head;
    *head = new;
    printf("Inserted %d at begin\n", value);
}



void display(node* head) {
    node* temp = head;
    if (temp == NULL) {
        printf("No element\n");
        return;
    }
    while (temp != NULL) {
        printf("%d\t", temp->value);
        temp = temp->next;
    }
    printf("\n");
}

void pop(node** head) {
    if (*head == NULL) {
        return;
    }
    node* temp = *head;
    *head = (*head)->next;
    printf("Popped %d\n",temp->value);
    free(temp);
}

void top(node* head)
{
        (head!=NULL)?printf("%d\n",head->value):printf("Empty\n");
}

int main() {
    node* head = NULL;

    printf("1. Push\n2. Pop\n3. Display\n4. Top\n0. Exit\n");

    int choice;
    char c;
    do {
        printf("\nEnter choice: ");
        scanf("%d", &choice);
```

```
        switch (choice) {
            case 1: {
                int x;
                printf("Enter node value: ");
                scanf("%d", &x);
                push(&head, x);
                break;
            }
            case 3:
                display(head);
                break;
            case 2:
                pop(&head);
                break;
                case 4: top(head);
                        break;
            case 0:
                break;
            default:
                printf("Invalid choice\n");
        }

        if ((c = getchar()) == '\n' || c == EOF) {}

    } while (choice != 0);

    printf("\nExiting...\n");
    return 0;
}
```

OUTPUT

```
❯ gcc stack.c -o stack
❯ ./stack
1. Push
2. Pop
3. Display
4. Top
0. Exit

Enter choice: 1
Enter node value: 2
Inserted 2 at begin

Enter choice: 1
Enter node value: 5
Inserted 5 at begin

Enter choice: 3
5       2

Enter choice: 4
5

Enter choice: 2
Popped 5

Enter choice: 2
Popped 2

Enter choice: 0

Exiting...
```



```
//Queue
void enqueue (node** head, node** tail, int value)
{
    node* new = createNode(value);
    new -> next = *head;
    if(*head == NULL)
      *tail = new;
    *head = new;
    printf("Enqueued %d\n", value);
}

void dequeue (node** head, node** tail)
{
    if(*tail == NULL)
    { return; }
    node* temp = *head;
    while (temp->next != NULL && temp->next->next != NULL)
      { temp = temp -> next; }
    printf("Dequeued %d\n", (*tail)->value);
    if(temp->next == NULL)
    {
      free(*tail);
      *head = *tail = NULL;
      return;
    }
    temp->next = NULL;
    free(*tail);
    *tail = temp;
}
```

```
void display (node* head)
{
    node* temp = head;
    if(temp == NULL)
    { printf("No element\n"); return; }
    while(temp != NULL)
    { printf("%d\t", temp->value); }
    printf("\n");
}
```

```
Output:

Enter choice: 1
Enter node value: 5
Enqueued 5

Enter choice: 1
Enter node value: 2
Enqueued 2

Enter choice: 3
2  5

Enter choice: 2
Dequeued 5

Enter choice: 2
Dequeued 2

Enter choice: 0

Exiting...
```

Code for Queue:

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

typedef struct node node;
struct node {
   int value;
   node* next;
};

node* createNode(int x) {
   node *n = (node*)malloc(sizeof(node));
   n->value = x;
   n->next = NULL;
   return n;
}

void enqueue(node** head, node** tail, int value) {
   node *new = createNode(value);
```

```
    new->next = *head;
    if(*head == NULL)
            *tail=new;
    *head = new;
    printf("Enqueued %d\n", value);
}



void display(node* head) {
    node* temp = head;
    if (temp == NULL) {
        printf("No element\n");
        return;
    }
    while (temp != NULL) {
        printf("%d\t", temp->value);
        temp = temp->next;
    }
    printf("\n");
}



void dequeue(node** head, node** tail) {
    if (*tail == NULL) {
        return;
    }
    node* temp = *head;
    while (temp->next != NULL && temp->next->next != NULL) {
        temp = temp->next;
    }
    printf("Dequeued %d\n",(*tail)->value);
    if(temp->next==NULL)
    {
            free(*tail);
            *head = *tail = NULL;
            return;
    }
    temp->next = NULL;
    free(*tail);
    *tail = temp;
}
```

```
int main() {
    node* head = NULL;
    node* tail = NULL;
    printf("1. Enqueue\n2. Dequeue\n3. Display\n0. Exit\n");

    int choice;
    char c;
    do {
        printf("\nEnter choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1: {
                int x;
                printf("Enter node value: ");
                scanf("%d", &x);
                enqueue(&head, &tail, x);
                break;
            }
            case 2: {
                dequeue(&head, &tail);
                break;
            }
            case 3:
                display(head);
                break;
            case 0:
                break;
            default:
                printf("Invalid choice\n");
        }

        if ((c = getchar()) == '\n' || c == EOF) {}

    } while (choice != 0);

    printf("\nExiting...\n");
    return 0;
}
```

OUTPUT

```
❯ gcc queue.c -o queue
❯ ./queue
1. Enqueue
2. Dequeue
3. Display
0. Exit

Enter choice: 1
Enter node value: 2
Enqueued 2

Enter choice: 1
Enter node value: 5
Enqueued 5

Enter choice: 3
5       2

Enter choice: 2
Dequeued 2

Enter choice: 2
Dequeued 5

Enter choice: 2

Enter choice: 0

Exiting...
```

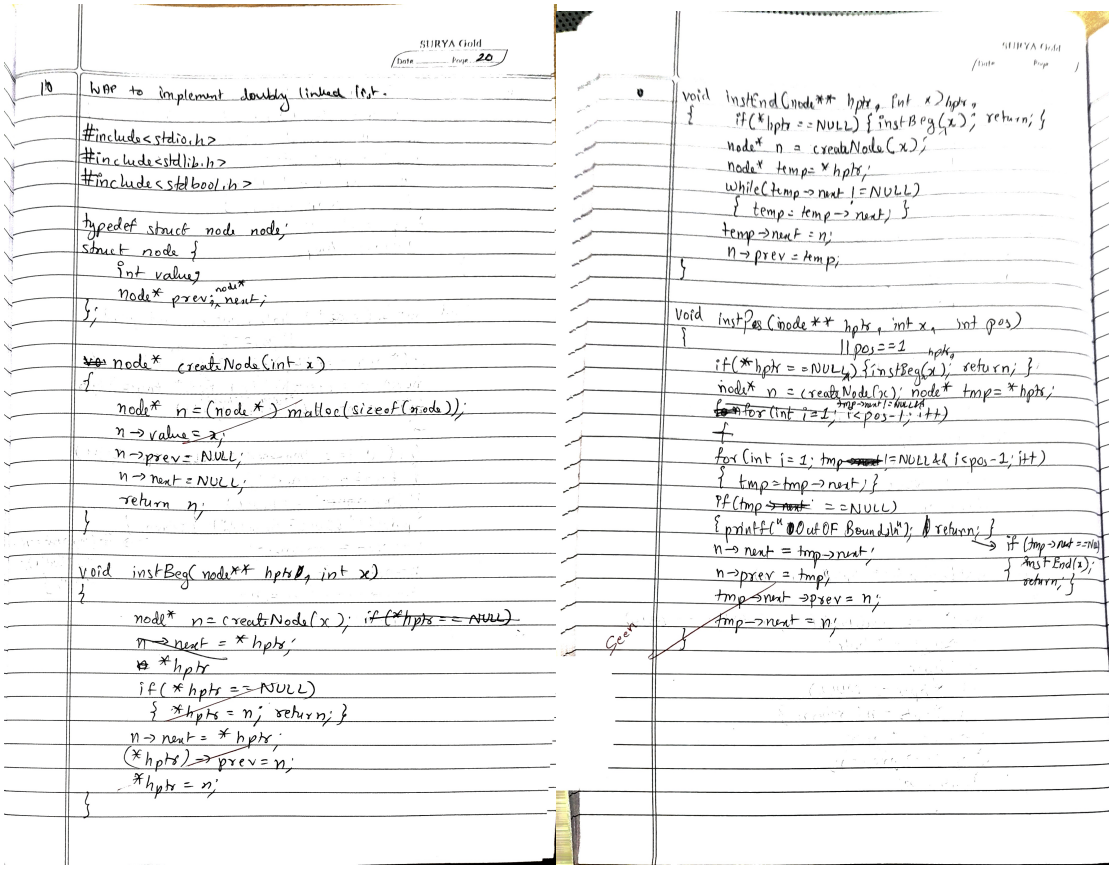
Program 7:

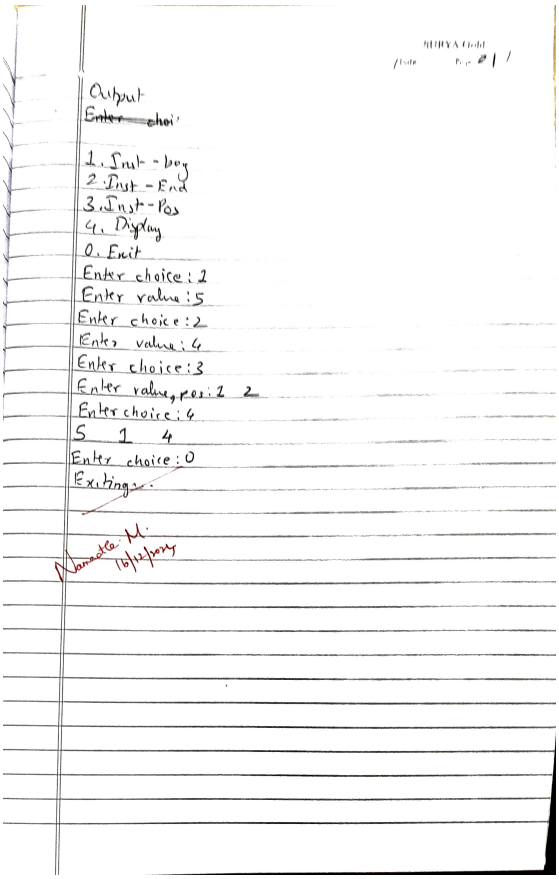
WAP to Implement doubly link list with primitive operations

a) Create a doubly linked list.

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

c) Display the contents of the list





Code:

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

typedef struct node node;
struct node{
        int value;
        node* prev;node* next;
};

node* createNode(int x)
{
        node* n = (node*)malloc(sizeof(node));
        n->value=x;
        n->prev=NULL;
        n->next=NULL;
}
```

```
void instBeg(node** hptr, int x)
{
	node* n = createNode(x);
	if(*hptr == NULL)
	{
		*hptr=n; return;
	}
	n->next=*hptr;
	(*hptr)->prev=n;
	*hptr=n;
}

void instEnd(node** hptr, int x)
{
	if(*hptr==NULL){instBeg(hptr, x);return;}
	node* n = createNode(x);
	node* temp = *hptr;

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

	temp->next=n;
	n->prev=temp;
}

void instPos(node** hptr, int x, int pos)
{
	if(*hptr==NULL||pos==1){instBeg(hptr, x);return;}
	node* n = createNode(x);
	node* tmp=*hptr;

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

	if(tmp==NULL){printf("OutOfBounds\n"); return;}
	if(tmp->next==NULL){instEnd(hptr, x);return;}
	n->next=tmp->next;
	n->prev=tmp;
	tmp->next->prev=n;
	tmp->next=n;
}

void display(node* head)
{
	node* temp=head;
```

```
	if(head==NULL){printf("Empty List\n");return;}
	while(temp!=NULL)
	{
		printf("%d\t",temp->value);
		temp=temp->next;
	}
	printf("\n");
}

void main()
{
	node* head = NULL;
	int choice;
	printf("1.Inst-beg\n2.Inst-End\n3.Inst-Pos\n4.Display\n0.Exit\n");
	do{
		printf("Enter choice:");
		scanf("%d",&choice);
		int x;
		switch(choice)
		{
			case 1: printf("Enter value:");
				scanf("%d",&x);
				instBeg(&head, x);
				break;
			case 2: printf("Enter value:");
				scanf("%d",&x);
				instEnd(&head, x);
				break;
			case 3: int pos;
				printf("Enter value, pos:");
				scanf("%d%d",&x,&pos);
				instPos(&head, x, pos);
				break;
			case 4: display(head);
				break;
			case 0: break;
			default:printf("Invalid input\n");
		}
	}while(choice!=0);
	printf("Exiting...");
}
```

OUTPUT

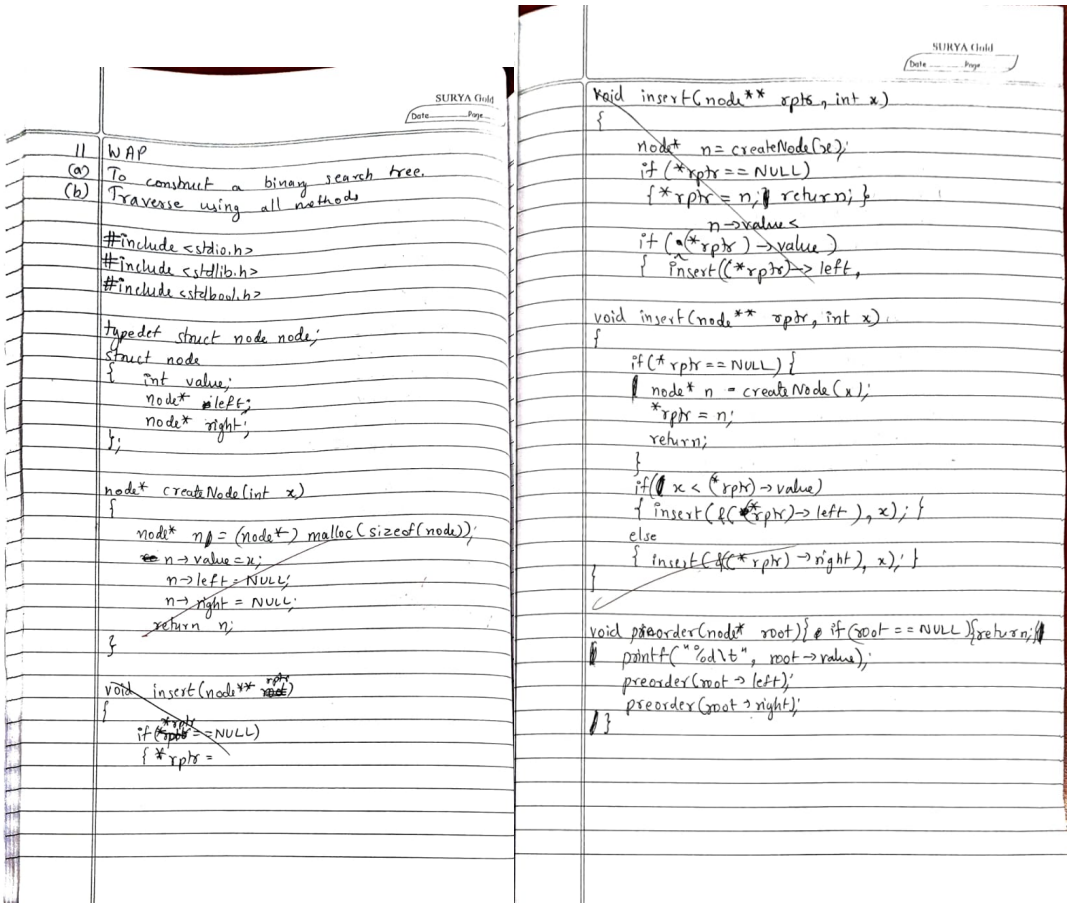
```
❯ gcc double.c -o double
❯ ./double
1.Inst-beg
2.Inst-End
3.Inst-Pos
4.Display
0.Exit
Enter choice:1
Enter value:5
Enter choice:2
Enter value:4
Enter choice:3
Enter value, pos:1 2
Enter choice:4
5       1       4
Enter choice:0
Exiting...%
```

Program 8 :

Write a program

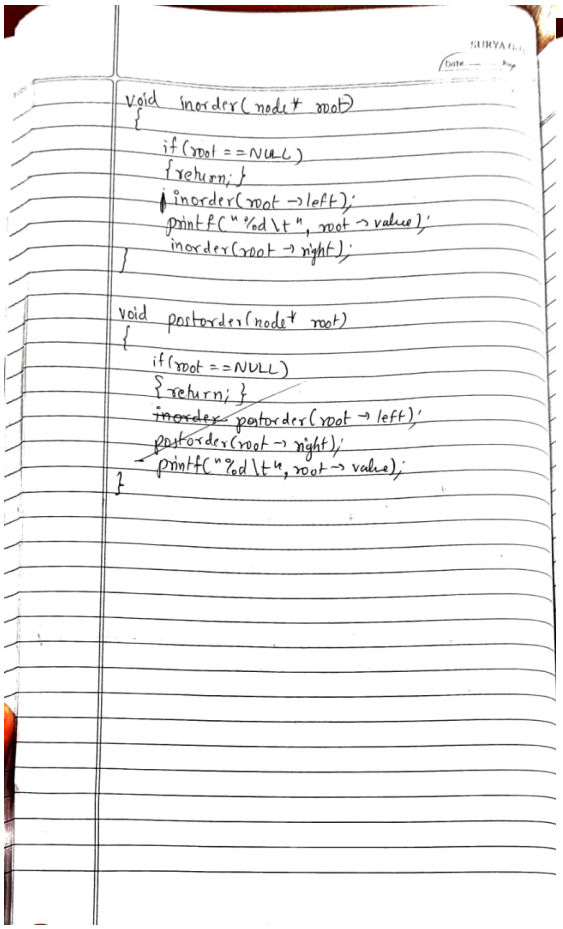
a) To construct a binary Search tree.

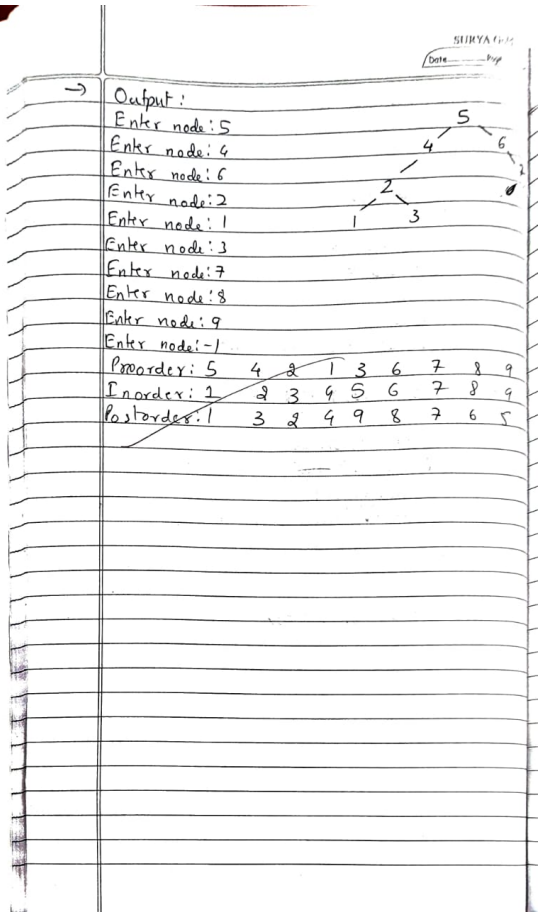
b) To traverse the tree using all the methods i.e., in-order, preorder and post order, display all traversal order



```
// WAP
// (a) To construct a binary search tree.
// (b) Traverse using all methods

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

typedef struct node node;
struct node
{
    int value;
    node* left;
    node* right;
};

node* createNode(int x)
{
    node* n = (node*) malloc(sizeof(node));
    n->value = x;
    n->left = NULL;
    n->right = NULL;
    return n;
}

void insert(node** rptr)
{
    if(*rptr == NULL)
    { *rptr =
```

```
void insert(node** rptr, int x)
{
    node* n = createNode(x);
    if (*rptr == NULL)
    {*rptr = n; return n;}
        n->value <
    if ((*rptr)->value)
    { insert((*rptr)->left,

void insert(node** rptr, int x)
{
    if(*rptr == NULL){
    node* n = createNode(x);
     *rptr = n;
     return;
    }
    if(x < (*rptr)->value)
    { insert(&((*rptr)->left), x); }
    else
    { insert(&((*rptr)->right), x); }
}

void preorder(node* root){ if(root == NULL){return;}
    printf("%d\t", root->value);
    preorder(root->left);
    preorder(root->right);
}
```





Code:

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

typedef struct node node;
struct node
{
	int value;
	node* left;
	node* right;
};

node* createNode(int x)
{
	node* n = (node*)malloc(sizeof(node));
	n->value=x;
	n->left=NULL;
	n->right=NULL;
	return n;
```

```
}

void insert(node** rptr, int x)
{
	if(*rptr==NULL)
	{
		node* n = createNode(x);
		*rptr=n;
		return;
	}
	if(x<(*rptr)->value)
	{insert(&((*rptr)->left), x);}
	else
	{insert(&((*rptr)->right), x);}
}

void preorder(node* root)
{
	if(root==NULL){return;}
	printf("%d\t", root->value);
	preorder(root->left);
	preorder(root->right);
}

void inorder(node* root)
{
	if(root==NULL){return;}
	inorder(root->left);
	printf("%d\t", root->value);
	inorder(root->right);
}

void postorder(node* root)
{
	if(root==NULL){return;}
	postorder(root->left);
	postorder(root->right);
	printf("%d\t", root->value);
}

void main()
{
	node* root = NULL;
	int x=0;
	while(x!=-1)
```

```
        {
                printf("Enter node:");
                scanf("%d",&x);
                if(x!=-1){insert(&root, x);}
        }
        printf("Preorder:");
        preorder(root);
        printf("\n");
        printf("Inorder:");
        inorder(root);
        printf("\n");
        printf("Postorder:");
        postorder(root);
        printf("\n");
}
```

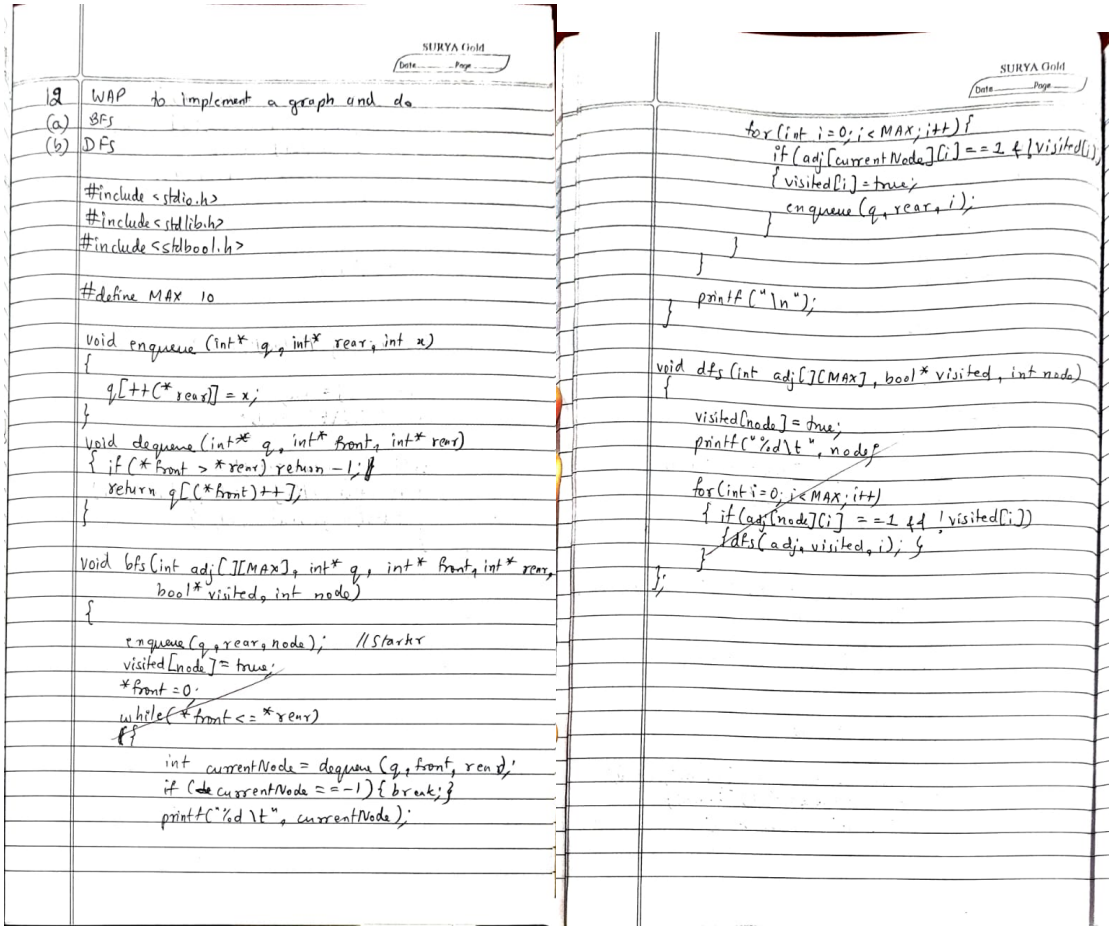
OUTPUT

```
❯ gcc tree.c -o tree
❯ ./tree
Enter node:5
Enter node:4
Enter node:6
Enter node:2
Enter node:1
Enter node:3
Enter node:7
Enter node:8
Enter node:9
Enter node:-1
Preorder:5      4       2       1       3       6       7       8       9
Inorder:1       2       3       4       5       6       7       8       9
Postorder:1     3       2       4       9       8       7       6       5
```

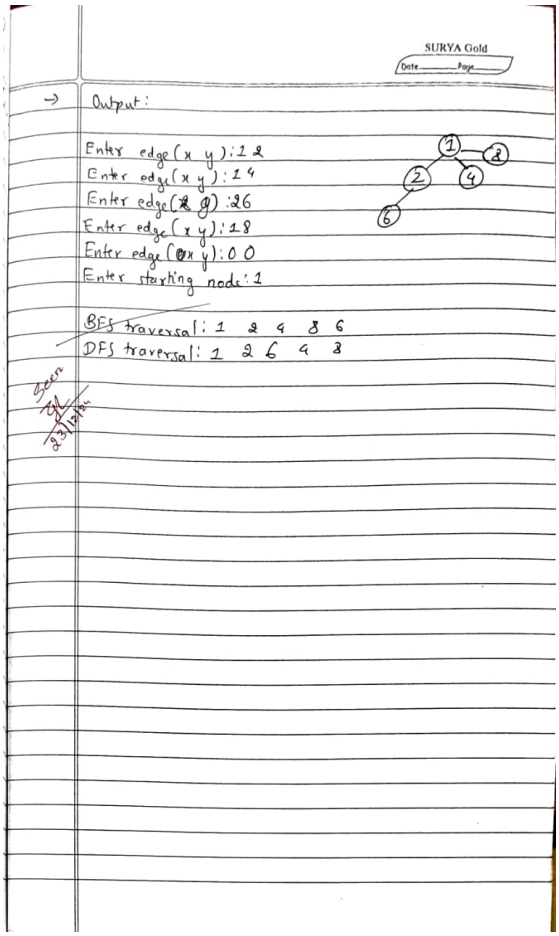
Program 9:

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

b) Write a program to traverse a graph using DFS method.



```
12  WAP to implement a graph and do
(a) BFS
(b) DFS

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

#define MAX 10

void enqueue (int* q, int* rear, int x)
{
   q[++(*rear)] = x;
}
void dequeue (int* q, int* front, int* rear)
{ if (*front > *rear) return -1;
  return q[(*front)++];
}

void bfs (int adj[][MAX], int* q, int* front, int* rear,
          bool* visited, int node)
{
    enqueue (q, rear, node);   //Starter
    visited[node] = true;
    *front = 0;
    while (*front <= *rear)
    {
        int currentNode = dequeue (q, front, rear);
        if (currentNode == -1) { break; }
        printf ("%d \t", currentNode);
        for (int i = 0; i < MAX; i++) {
            if (adj[currentNode][i] == 1 && !visited[i])
            { visited[i] = true;
              enqueue (q, rear, i);
            }
        }
    }
    printf ("\n");
}

void dfs (int adj[][MAX], bool* visited, int node)
{
    visited[node] = true;
    printf ("%d \t", node);

    for (int i = 0; i < MAX; i++)
    { if (adj[node][i] == 1 && !visited[i])
        dfs (adj, visited, i); }
}
```



Code:

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

#define MAX 10

// Function to enqueue an element into the queue
void enqueue(int* q, int* rear, int x) {
    q[++(*rear)] = x;
}

// Function to dequeue an element from the queue
int dequeue(int* q, int* front, int* rear) {
    if (*front > *rear) return -1; // Queue is empty
    return q[(*front)++];
}

// Function to perform BFS
void bfs(int adj[][MAX], int* q, int* front, int* rear, bool* visited, int node) {
```

```
    enqueue(q, rear, node);
    visited[node] = true;
    *front = 0; // Set front to 0 after the first enqueue

    while (*front <= *rear) {
        int currentNode = dequeue(q, front, rear);

        if (currentNode == -1) {
            break;
        }

        printf("%d\t", currentNode); // Display the visited node

        // Check all adjacent nodes
        for (int i = 0; i < MAX; i++) {
            if (adj[currentNode][i] == 1 && !visited[i]) {
                visited[i] = true;
                enqueue(q, rear, i); // Enqueue the unvisited node
            }
        }
    }
    printf("\n");
}

// Function to perform DFS
void dfs(int adj[][MAX], bool* visited, int node) {
    visited[node] = true;
    printf("%d\t", node); // Display the visited node

    // Visit all adjacent unvisited nodes recursively
    for (int i = 0; i < MAX; i++) {
        if (adj[node][i] == 1 && !visited[i]) {
            dfs(adj, visited, i);
        }
    }
}

int main() {
    int adj[MAX][MAX] = {0}; // Adjacency matrix
    bool visited[MAX] = {false}; // Visited array
    int q[MAX]; // Queue for BFS
    int front = -1, rear = -1; // Queue pointers
    int x, y;

    // Input the graph as an undirected graph
```

```
    do {
        printf("Enter edge (x y): ");
        scanf("%d%d", &x, &y);
        if (x == y) {
            break;
        }
        adj[x][y] = 1;
        adj[y][x] = 1; // Since it's an undirected graph
    } while (x != y);

    printf("Enter starting node: ");
    scanf("%d", &x);

    // Perform BFS
    printf("BFS traversal: ");
    bfs(adj, q, &front, &rear, visited, x);

    // Reset visited array for DFS
    for (int i = 0; i < MAX; i++) {
        visited[i] = false;
    }

    // Perform DFS
    printf("DFS traversal: ");
    dfs(adj, visited, x);
    printf("\n");

    return 0;
}
```

OUTPUT

```
❯ gcc graph.c -o graph
❯ ./graph
Enter edge (x y): 1 2
Enter edge (x y): 1 4
Enter edge (x y): 2 6
Enter edge (x y): 1 8
Enter edge (x y): 0 0
Enter starting node: 1
BFS traversal: 1        2       4       8       6
DFS traversal: 1        2       6       4       8
```