VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

Data Structures using C Lab

(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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B.M.S. College of Engineering,
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 **Shaikh Uzair Ahmed (1BM23CS307),** 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.

Lab faculty Incharge Namratha M Assistant Professor Department of CSE, BMSCE	Dr. Kavitha Sooda Professor & HOD Department of CSE, BMSCE

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Github Link:
https://github.com/Shaikh-Uzair-Ahmed/1BM23CS307

Program 1

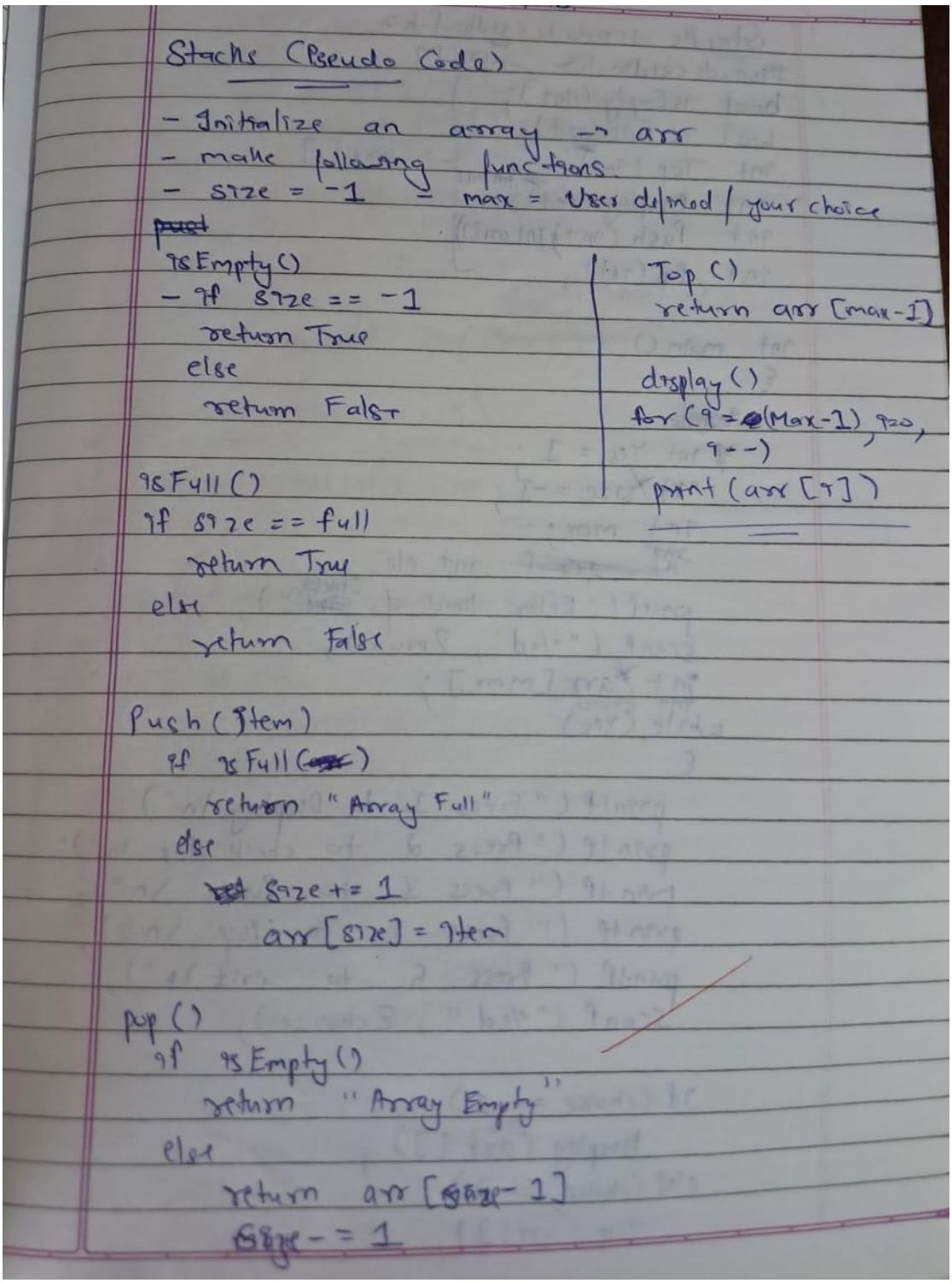
Write a program to simulate the working of stack using an array with the following:

a) Push

b) Pop

c) Display

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

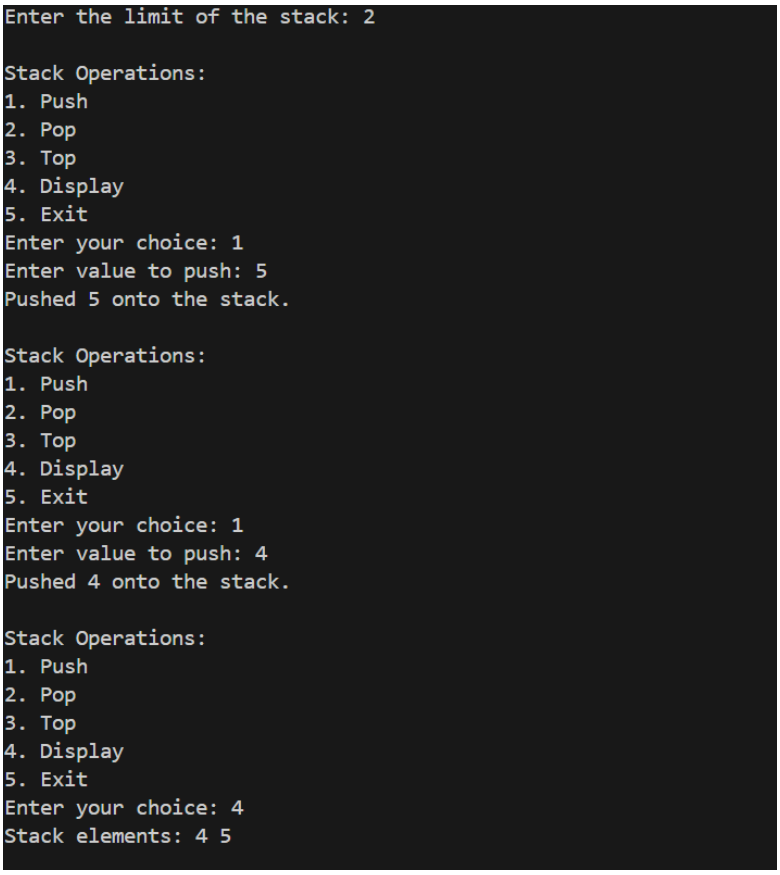


Code:

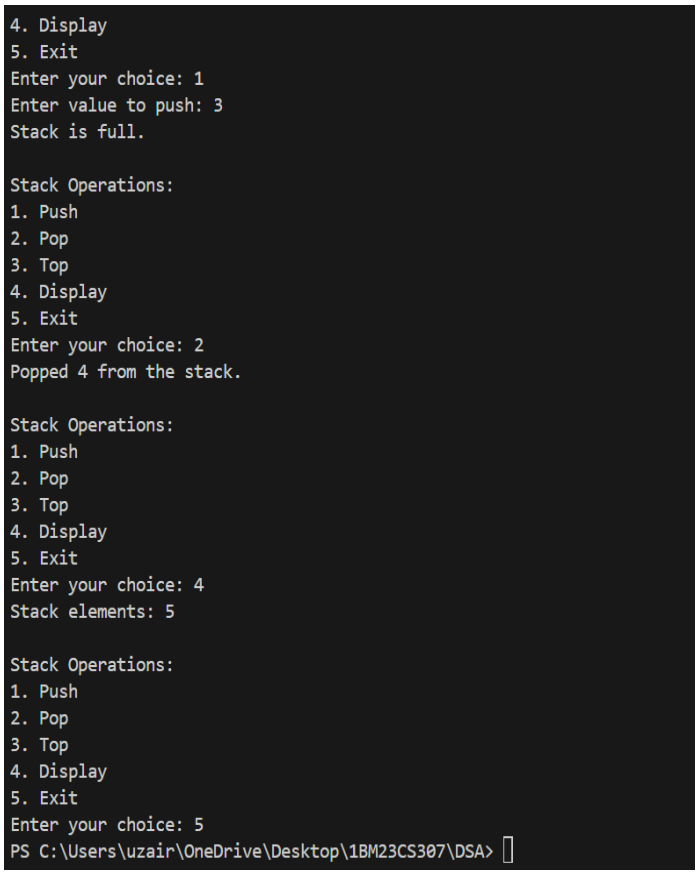
```
#include <stdio.h>
#include <stdlib.h>

int top = -1;


int isEmpty(int arr[]) {
   return top == -1;
}

int isFull(int arr[], int limit) {
   return top == limit - 1;
}

int Top(int arr[]) {
   if (isEmpty(arr)) {
      printf("Stack is empty.\n");
      return -1;
   }
   return arr[top];
}

void Display(int arr[]) {
   if (isEmpty(arr)) {
      printf("Stack is empty.\n");
      return;
   }
   printf("Stack elements: ");
   for (int i = top; i >= 0; i--) {
      printf("%d ", arr[i]);
   }
   printf("\n");
}


void Push(int value, int arr[], int limit) {
   if (isFull(arr, limit)) {
      printf("Stack is full.\n");
   } else {
      top++;
      arr[top] = value;
      printf("Pushed %d onto the stack.\n", value);
   }
}
```

```
void Pop(int arr[]) {
    if (isEmpty(arr)) {
        printf("Stack is empty.\n");
    } else {
        printf("Popped %d from the stack.\n", arr[top]);
        top--;
    }
}

int main() {
    int limit;

    printf("Enter the limit of the stack: ");
    scanf("%d", &limit);

    int arr[limit];

    while (1) {
        int choice, value;
        printf("\nStack Operations:\n");
        printf("1. Push\n");
        printf("2. Pop\n");
        printf("3. Top\n");
        printf("4. Display\n");
        printf("5. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter value to push: ");
                scanf("%d", &value);
                Push(value, arr, limit);
                break;
            case 2:
                Pop(arr);
                break;
            case 3:
                printf("Top element is: %d\n", Top(arr));
                break;
            case 4:
                Display(arr);
                break;
            case 5:
                exit(0);
            default:
```

```
            printf("Invalid choice. Please try again.\n");
        }
    }

    return 0;
}
```



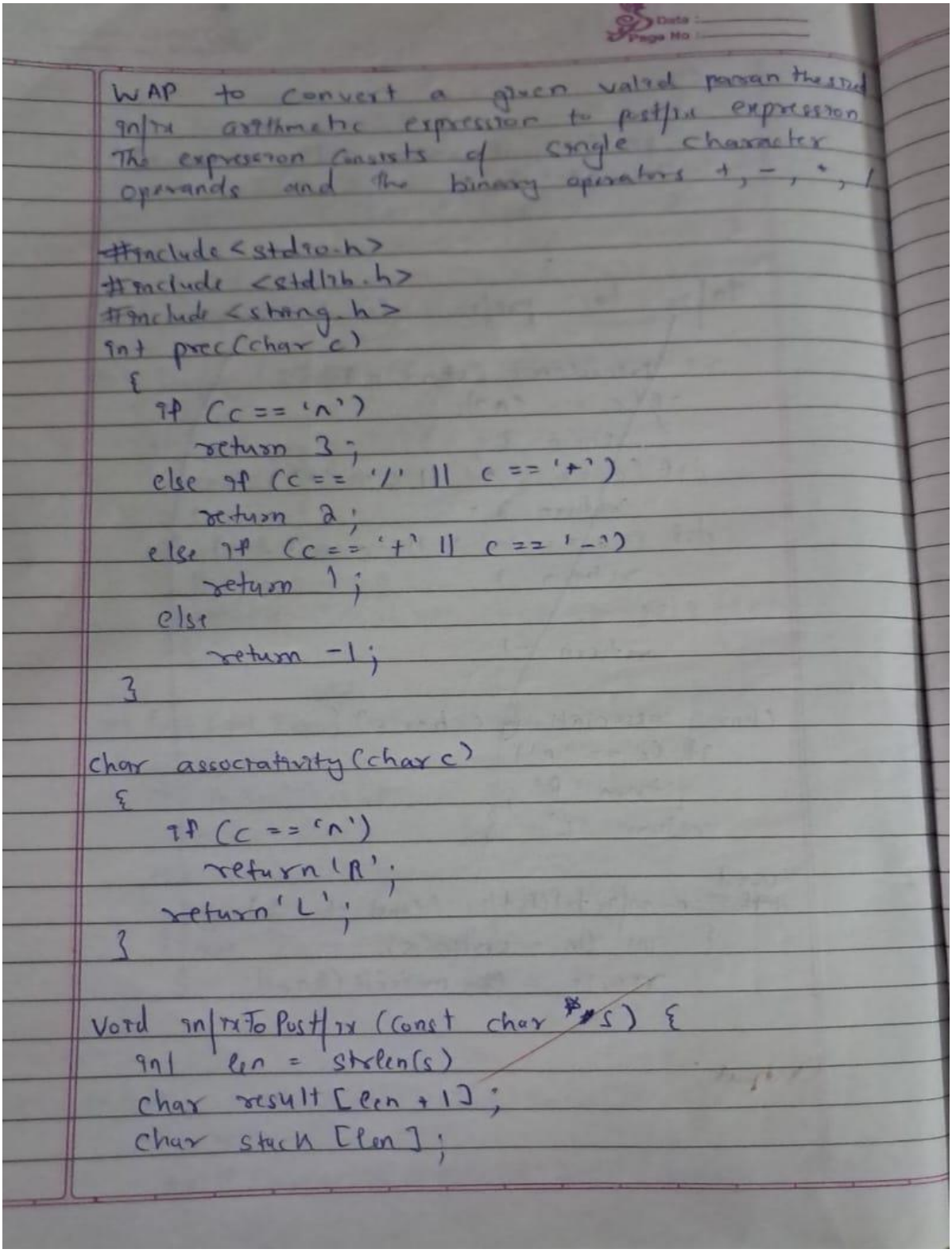
Output 1



Output 2

Program 2

Write a program to convert a given valid parenthesized in-fix arithmetic expression to post-fix expression.The expression consists of single character operands and the binary operators +,-,*,/.



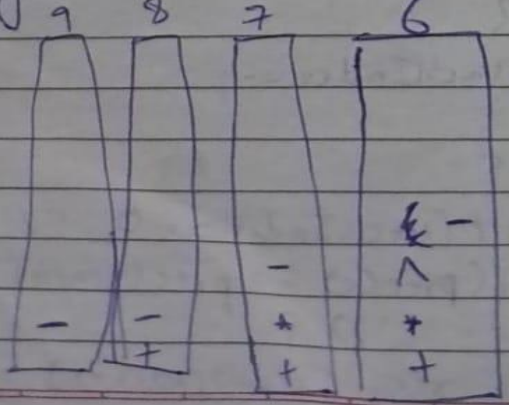
```
WAP to convert a given valid paran thesized
infix arithmetic expression to postfix expression
The expression consists of single character
operands and the binary operators +, -, *, /

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
int prec(char c)
 {
   if (c == '^')
      return 3;
   else if (c == '/' || c == '*')
      return 2;
   else if (c == '+' || c == '-')
      return 1;
   else
      return -1;
 }

char associativity(char c)
 {
    if (c == '^')
      return 'R';
    return 'L';
 }

void infixToPostfix (const char *s) {
   int len = strlen(s)
   char result [len + 1];
   char stack [len];
```

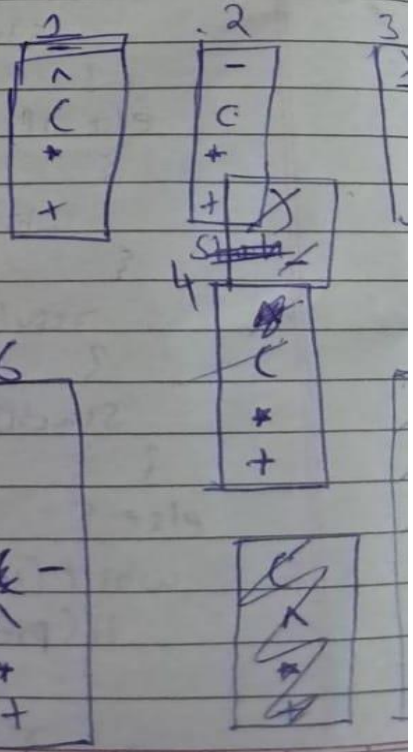
```
int resultIndex = 0;
int stackIndex = -1;

if (!result || !stack) {
    printf("Memory allocation failed!\n");
    return;
}

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

    if ((c >= 'a' && c <= 'z') || (c >= 'A' && c <= 'Z')
        || (c >= '0' && c <= '9'))
    {
        result[resultIndex++] = c;
    }
    else if (c == '(') {
        stack[++stackIndex] = c;
    }
    else if (c == ')')
    {
        while(stackIndex >= 0 && stack[stackIndex] != '(')
        {
            result[resultIndex++] = stack[stackIndex--];
        }
        stackIndex--;
    }
    else {
    while (stackIndex >= 0 && (prec(c) < prec(stack[stackIn
        || (prec(c) == prec(stack[stackIndex]) && associativity(c)
        == 'L')) {
            result[resultIndex++] = stack[stackIndex--];
    }
```

```
stack[++stackIndex] = c;
}//end for //end else
}// end function  // end for

while (stackIndex >= 0){
    result[resultIndex++] = stack[stackIndex--];
}

result[resultIndex] = '\0';
printf("%s\n", result);

int main(){
  char exp[] = "a+b^(c^d-e)^(f+g*h)-i";
infixToPostfix(exp);
return 0;
}
```

Output:

abcd^e-fgh*+^*+i-





Code:

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

int prec(char c){
    if (c == '+' || c == '-') {
        return 1;
    }
    if (c == '*' || c == '/') {
        return 2;
    }
    if (c == '^') {
        return 3;
    }
    return 0;
}

char associativity(char c){
    if(c=='^')
        return 'R';
    return 'L';
}

void infixtopostfix(const char *s){
    int len = strlen(s);
    char result[len+1];
    char stack[len];
    int resultIndex=0;
    int StackIndex=-1;

    if(!result || !stack){
        printf("Memory Allocation Failed \n");
        return;
    }

    for (int i = 0; i < len; i++)
    {
        char c=s[i];
        if ((c>='a' && c<='z') || (c>='A' && c<='Z'))
        {
            result[resultIndex++] = c;
        }
        else if(c=='('){
            stack[++StackIndex]=c;
        }
```

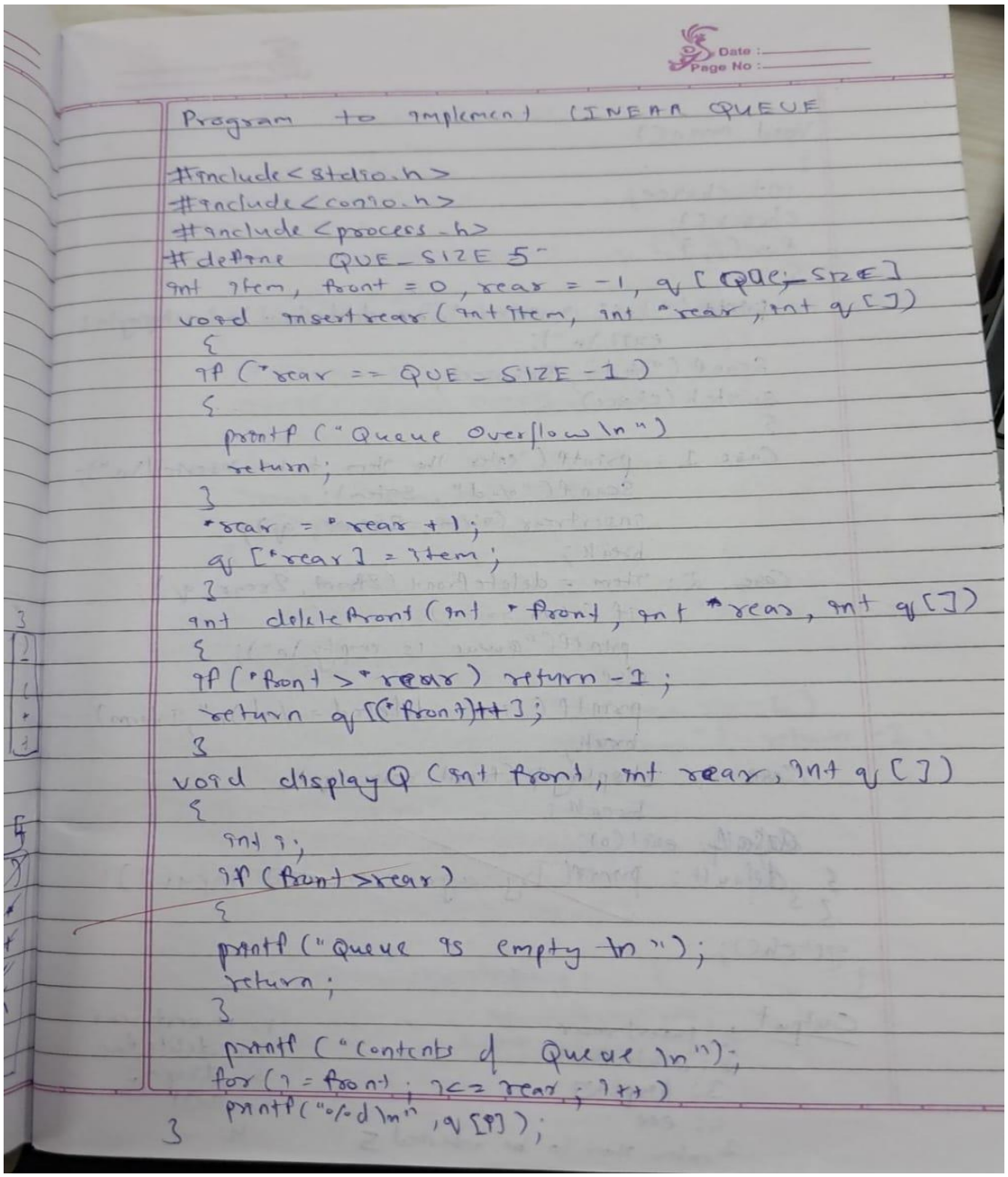
```
        else if(c==')'){
            while (StackIndex>=0 && stack[StackIndex]!='(')
            {
                result[resultIndex++]=stack[StackIndex--];
            }
           StackIndex--;
        }
        else{
            while (StackIndex>=0 && (prec(c))<prec(stack[StackIndex]) ||
(prec(c)==prec(stack[StackIndex]) && associativity(c)=='L'))
            {
                result[resultIndex++]=stack[StackIndex--];
            }
            stack[++StackIndex]=c;
        }
    }

    while (StackIndex>=0)
    {
        result[resultIndex++]=stack[StackIndex--];
    }
    result[resultIndex++]='\0';
    printf("%s\n",result);
}

int main(){
    char exp[] = "a+b*(c^d-e)^(f+g*h)-i";
    infixtopostfix(exp);
    return 0;
}
```

```
PS C:\Users\uzair\OneDrive\Desktop\1BM23CS307\DSA> cd "c:\Users\uzair\OneDrive\Desktop\1BM23CS307\DSA\" ; if ($?) { gcc infi
xpostfix.c -o infixpostfix } ; if ($?) { .\infixpostfix }
abcd^e-fgh*+^*+i-
```

Output

Program 3

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.



```
Program to implement LINEAR QUEUE

#include<stdio.h>
#include<conio.h>
#include<process.h>
#define QUE_SIZE 5
int item, front = 0, rear = -1, q[QUE_SIZE]
void insertrear(int item, int *rear, int q[])
{
if(*rear == QUE_SIZE-1)
{
printf("Queue Overflow\n")
return;
}
*rear = *rear + 1;
q[*rear] = item;
}
int deletefront(int *front, int *rear, int q[])
{
if(*front > *rear) return -1;
return q[(*front)++];
}
void displayQ(int front, int rear, int q[])
{
int i;
if(front>rear)
{
printf("Queue is empty\n");
return;
}
printf("contents of Queue\n");
for(i=front; i<=rear; i++)
printf("%d\n", q[i]);
}
```

```
Void main()
{
 int choice;
 clrscr();
 for(;;)
 {
  printf("\n1: insertrear\n2: deletefront\n3: display\n
        exit\n");
  scanf("%d", &choice);
  switch(choice)
  {
  case 1: printf("enter the item to be inserted\n");
          scanf("%d", &item);
          insertrear(item, &rear, q);
          break;
  case 2: item = deletefront(&front, &rear, q);
          if(item == -1)
           printf("queue is empty\n");
          else
          printf("item deleted = %d\n", item);
          break;
  case 3: displayQ(front, rear, q);
          break;
  default: exit(0);
  }
 default: printf("Try again invalid input");
 }
getch();
}
```

Output

1. insertrear
2: deletefront
3: display
4: exit
1 enter item to be inserted 5

1. insertrear
2. deletefron
3. display
4: exit
4

Code:

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

#define QUE_SIZE 5

int item, front = 0, rear = -1, q[N];

void insertrear(int item, int *rear, int q[]) {
   if (*rear == N - 1) {
      printf("Queue Overflow \n");
      return;
   }
   *rear = *rear + 1;
   q[*rear] = item;
}

int Deque(int *front, int *rear, int q[]) {
   if (*front > *rear) {
      return -1;
   }
   return q[(*front)++];
}

void displayQ(int front, int rear, int q[]) {
   if (front > rear) {
      printf("Queue is empty \n");
      return;
   }
   printf("Contents of Queue:\n");
   for (int i = front; i <= rear; i++) {
      printf("%d \n", q[i]);
   }
}

int main() {
   int choice;
   for (;;) {
      printf("\n1: Insert rear\n2: Delete front\n3: Display\n4: Exit\n");
      scanf("%d", &choice);
```

```
        switch (choice) {
            case 1:
                printf("Enter the item to be inserted: ");
                scanf("%d", &item);
                insertrear(item, &rear, q);
                break;
            case 2:
                item = Deque(&front, &rear, q);
                if (item == -1)
                    printf("Queue is empty\n");
                else
                    printf("Item deleted = %d \n", item);
                break;
            case 3:
                displayQ(front, rear, q);
                break;
            case 4:
                exit(0);
            default:
                printf("Invalid choice, please try again.\n");
        }
    }
    return 0;
}
```

```
1: Insert rear
2: Delete front
3: Display
4: Exit
1
Enter the item to be inserted: 10

1: Insert rear
2: Delete front
3: Display
4: Exit
2
Item deleted = 2

1: Insert rear
2: Delete front
3: Display
4: Exit
2
Item deleted = 5

1: Insert rear
2: Delete front
3: Display
4: Exit
3
Contents of Queue:
2
4
10
```

Output 1

```
1: Insert rear
2: Delete front
3: Display
4: Exit
1
Enter the item to be inserted: 2

1: Insert rear
2: Delete front
3: Display
4: Exit
1
Enter the item to be inserted: 5

1: Insert rear
2: Delete front
3: Display
4: Exit
1
Enter the item to be inserted: 2

1: Insert rear
2: Delete front
3: Display
4: Exit
1
Enter the item to be inserted: 4
```

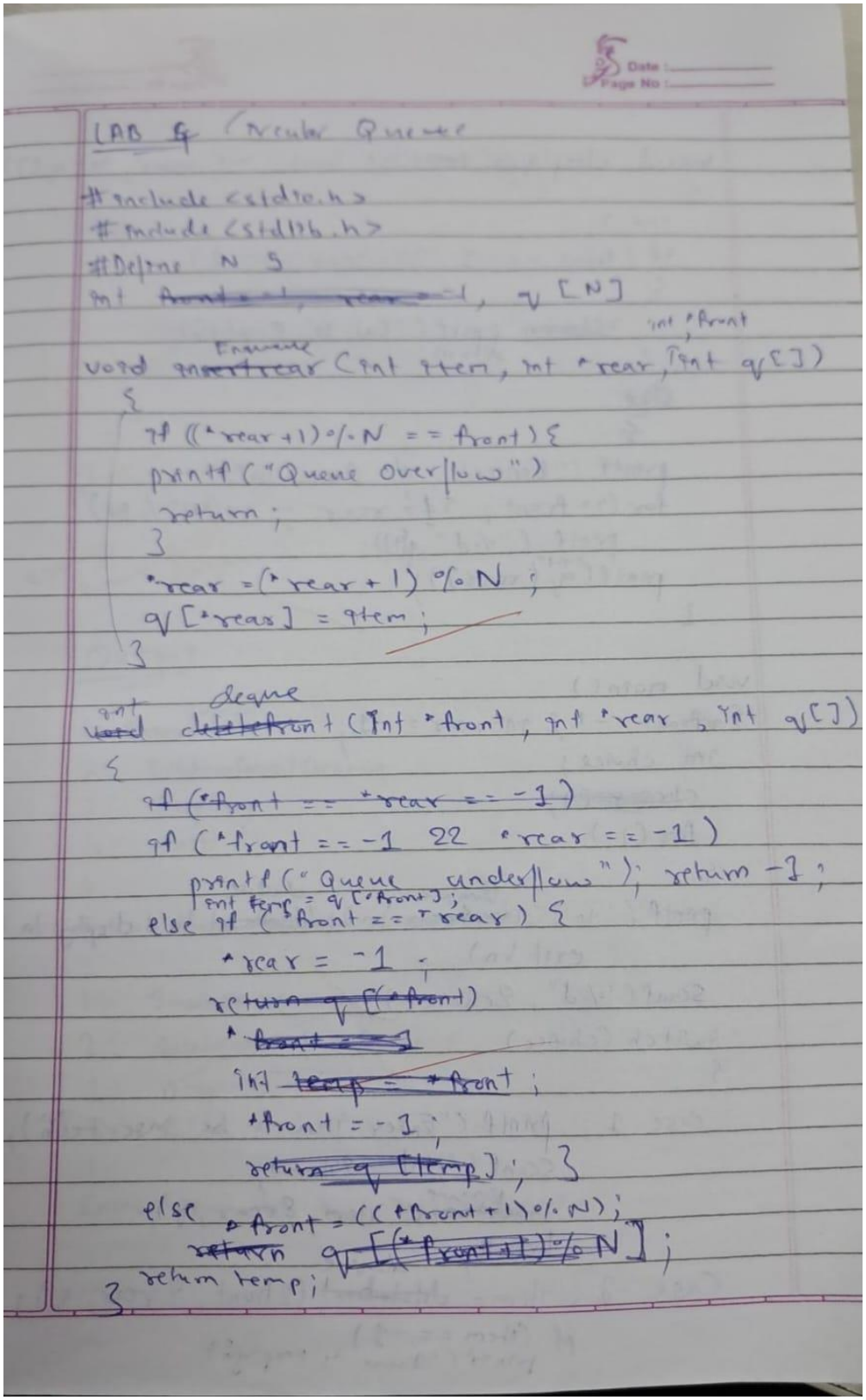
Output 2

```
1: Insert rear
2: Delete front
3: Display
4: Exit
4
PS C:\Users\uzair\OneDrive\Desktop\1BM23CS307\DSA>
```

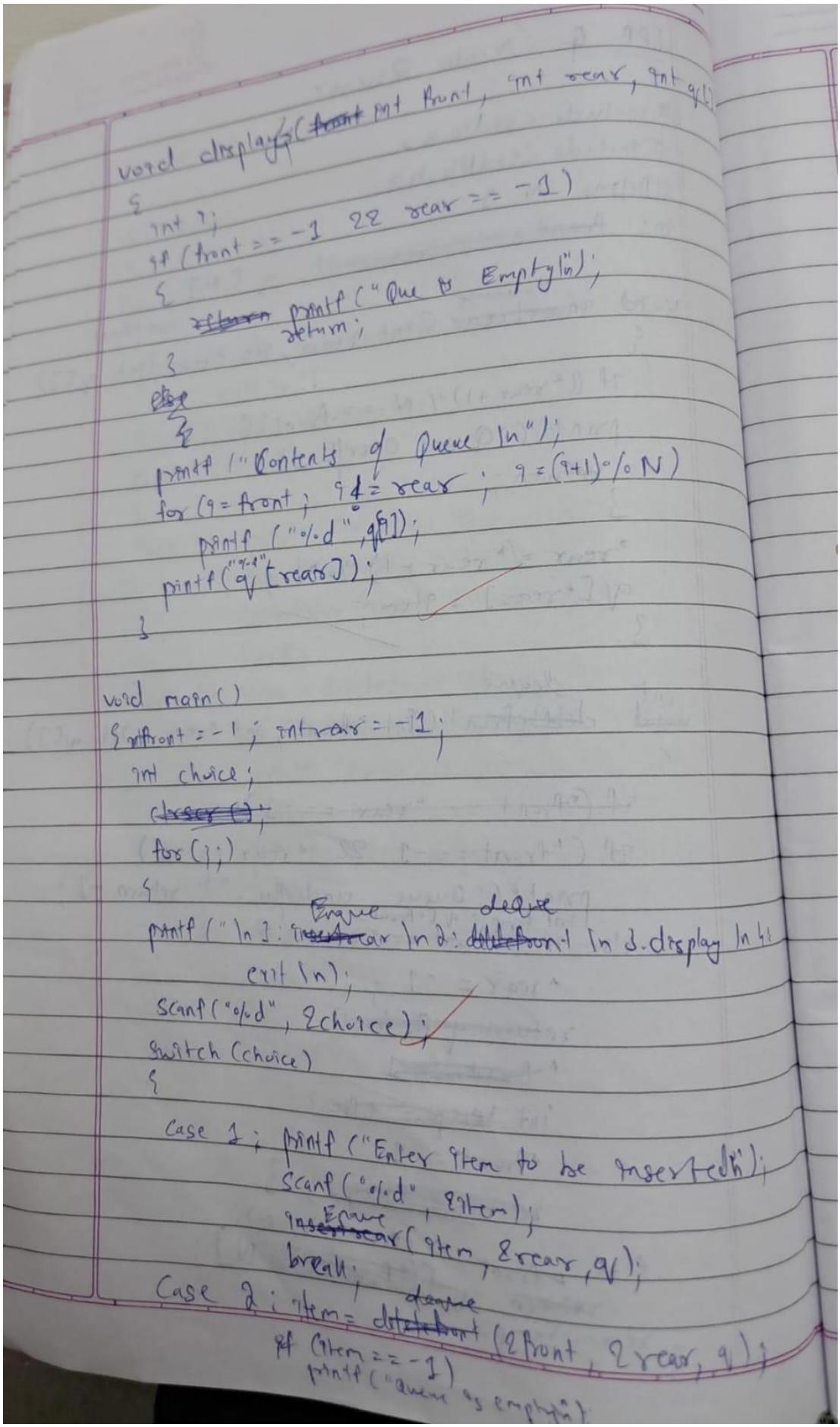
Output 3

Program 4

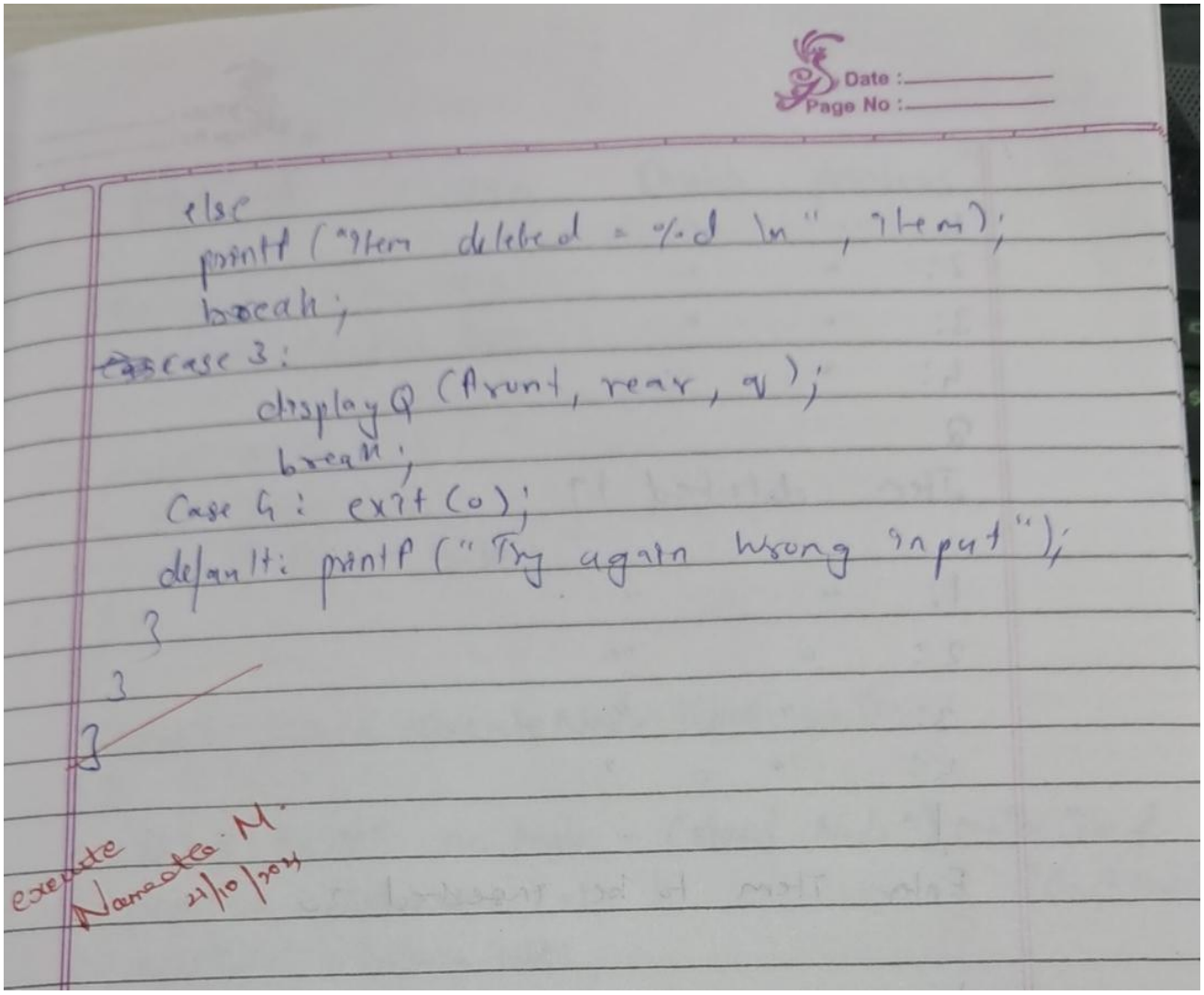
WAP to simulate the working of a circular queue of integers using an array. Provide the following operations: Insert, Delete & Display.
The program should print appropriate messages for queue empty and queue overflow conditions.



```
LAB 5 Circular Queue

#include <stdio.h>
#include <stdlib.h>
#Define N 5
int front = -1, rear = -1, q[N]

void enqueue(int item, int *rear, int *front, int q[])
{
  if ((*rear+1)%N == front){
  printf("Queue Overflow")
  return;
  }
  *rear = (*rear + 1) % N;
  q[*rear] = item;
}

int dequeue(int *front, int *rear, int q[])
{
  if (*front == -1 && *rear == -1)
    printf("Queue underflow"); return -1;
  int temp = q[*front];
  else if (*front == *rear) {
    *rear = -1;
    return q[(*front)
    *front = -1
    int temp = *front;
    *front = -1;
    return q[temp]; }
  else
    *front = ((*front+1)%N);
    return q[(*front+1)%N];
  return temp;
}
```



```
void display(int front, int rear, int q[])
{
 int i;
 if (front == -1 && rear == -1)
 {
  printf("Que is Empty\n");
  return;
 }
 printf("Contents of Queue \n");
 for (i = front; i != rear ; i = (i+1) % N)
  printf("%d", q[i]);
 printf("%d", q[rear]);
}

void main()
{ int front = -1; int rear = -1;
 int choice;
 for(;;)
 {
 printf("\n 1: Enque \n 2: deQue \n 3. display \n 4:
        exit \n");
 scanf("%d", &choice);
 switch (choice)
 {
  case 1: printf("Enter item to be inserted");
          scanf("%d", &item);
          Enque(item, &rear, q);
          break;
  Case 2: item = dequeue(&front, &rear, q);
          if (item == -1)
          printf("queue is empty");
```

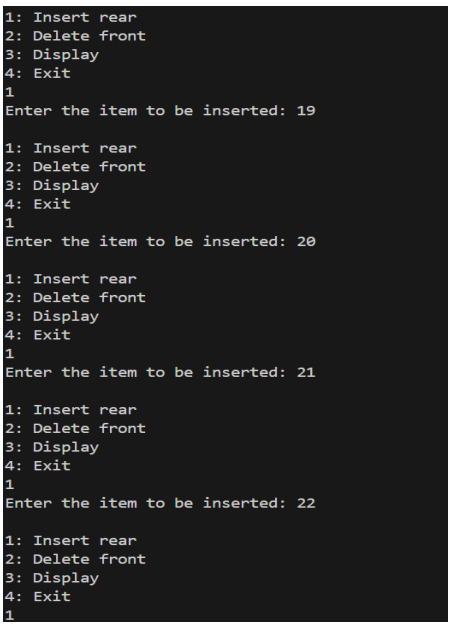


Code:

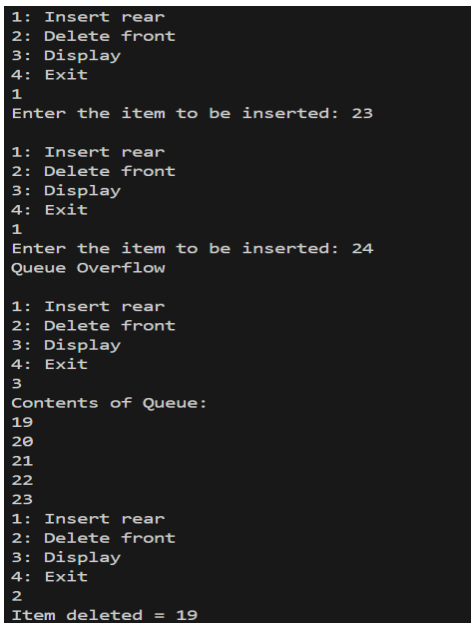
```
#include <stdio.h>
#include <stdlib.h>

#define N 5

int q[N];

void Enqueue(int item, int *rear,int *front , int q[]) {
   if (((*rear+1)%N) == *front) {
      printf("Queue Overflow \n");
      return;
   }
   if (*front == -1)
   {
      *front = 0;
```

```
    }

    *rear = ((*rear + 1)%N);
    q[*rear] = item;
}

int Deque(int *front, int *rear, int q[]) {
    if (*front == -1 && *rear == -1) {
        return -1;
    }
    int temp = q[*front];
    if(*front == *rear){
        *rear = -1;
        *front = -1;
    }
    else{
        *front = ((*front+1)%N);
    }
    return temp;
}

void displayQ(int front, int rear, int q[]) {
    if (front == -1 &&  rear == -1) {
        printf("Queue is empty \n");
        return;
    }
    printf("Contents of Queue:\n");
    for (int i = front; i != rear; i=(i+1)%N) {
        printf("%d \n", q[i]);
    }
    printf("%d",q[rear]);
}

int main() {
    int choice;
    int rear = -1;
    int front = -1;
    int item;
    for (;;) {
        printf("\n1: Enque\n2: Deque1\n3: Display\n4: Exit\n");
        scanf("%d", &choice);
        switch (choice) {
```

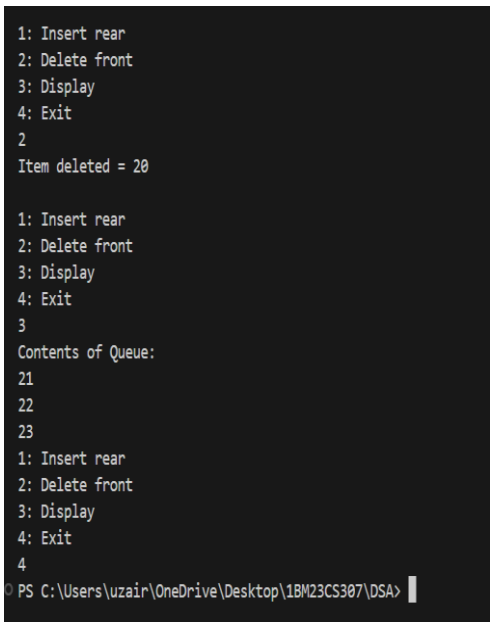
```
            case 1:
                printf("Enter the item to be inserted: ");
                scanf("%d", &item);
                Enqueue(item, &rear, &front , q);
                break;
            case 2:
                item = Deque(&front, &rear, q);
                if (item == -1)
                    printf("Queue is empty\n");
                else
                    printf("Item deleted = %d \n", item);
                break;
            case 3:
                displayQ(front, rear, q);
                break;
            case 4:
                exit(0);
            default:
                printf("Invalid choice, please try again.\n");
        }
    }
    return 0;
}
```



Output 1



Output 2



Output 3

Program 5

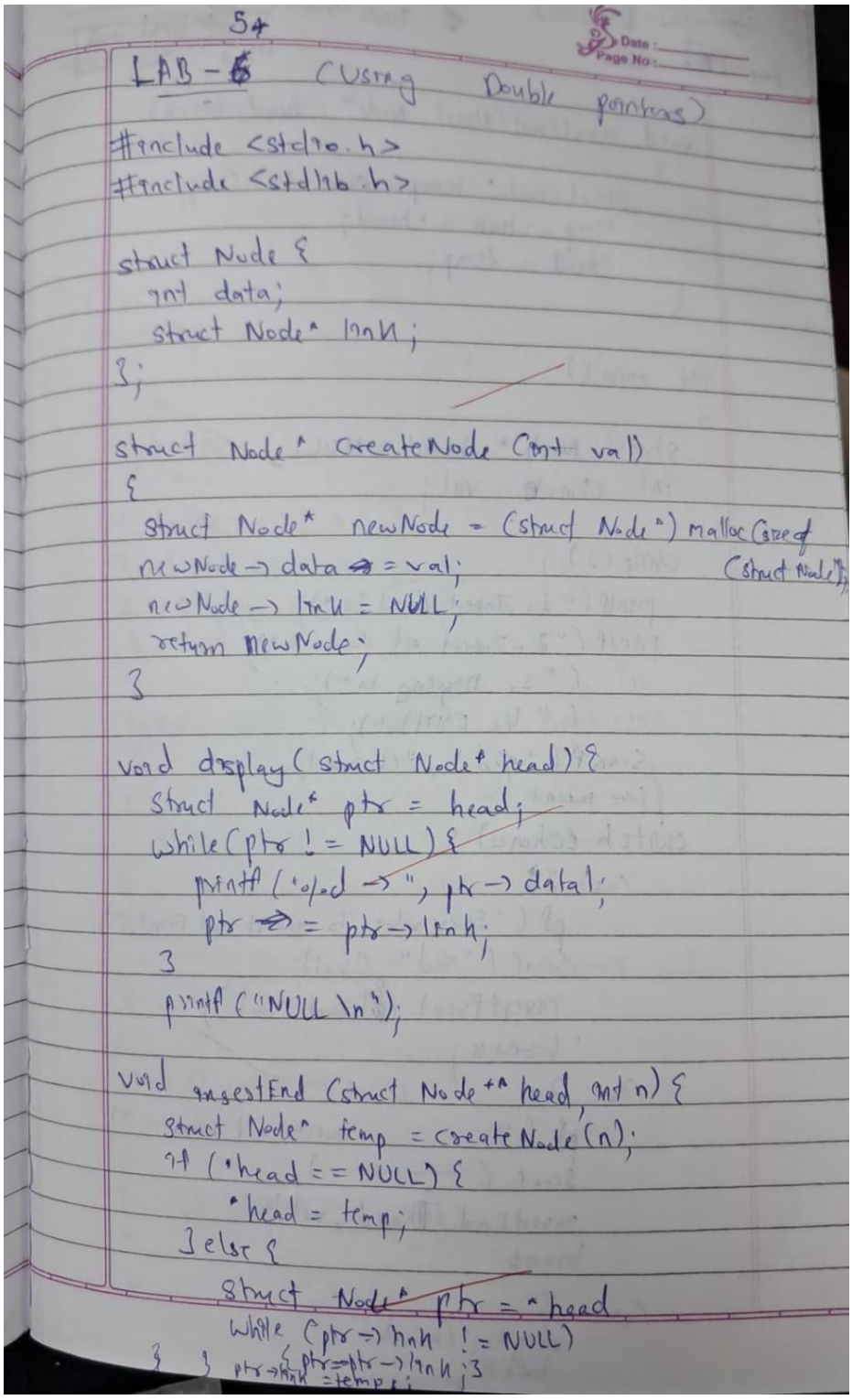
Write a program to Implement Singly Linked List with following operations

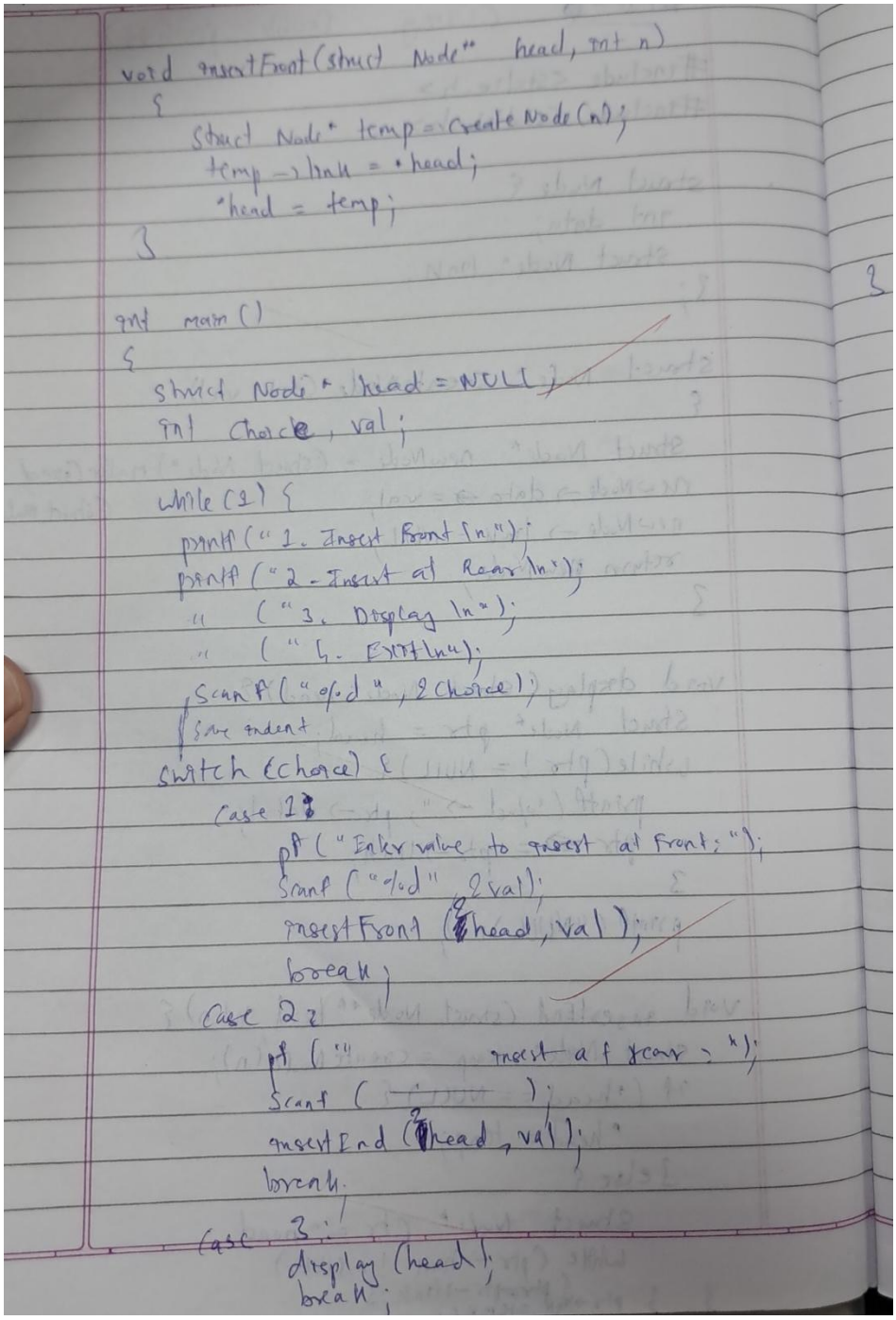
a) Create a linked list.

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

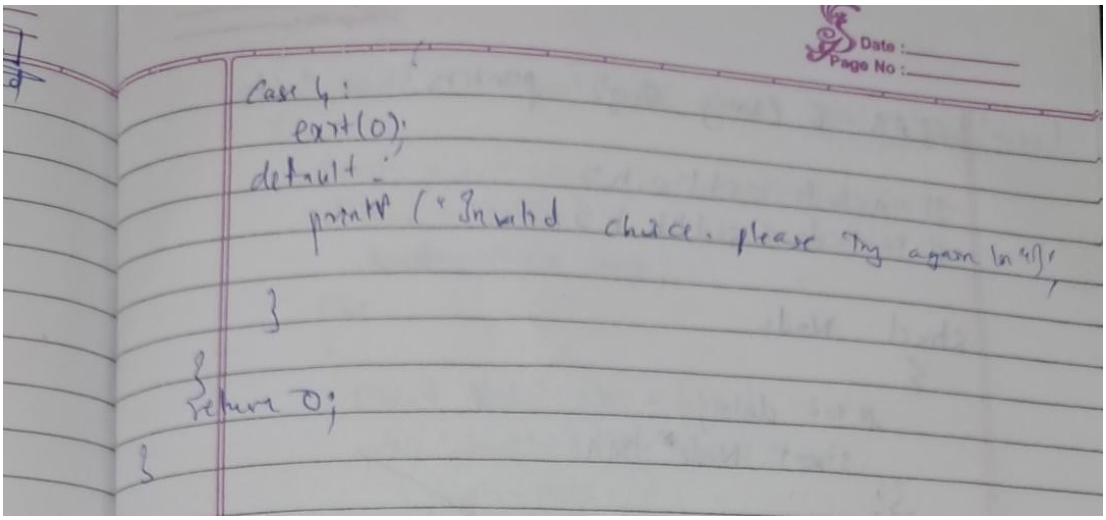
Display the contents of the linked list.

Leetcode problem no.20 (Valid parantheses)





```
void insertFront(struct Node** head, int n)
{
    struct Node* temp = createNode(n);
    temp->link = *head;
    *head = temp;
}

int main()
{
    struct Node* head = NULL;
    int choice, val;
    while(1) {
    printf("1. Insert Front \n");
    printf("2 - Insert at Rear \n");
    "   ("3. Display \n");
    "   ("4. Exit\n");
    scanf("%d", &choice);
    save indent
switch(choice) {
    case 1:
        pf("Enter value to insert at Front: ");
        scanf("%d", &val);
        insertFront(&head, val);
        break;
    case 2:
        pf("          insert at rear : ");
        scanf(          );
        insertEnd(&head, val);
        break;
    case 3:
        display(head);
        break;
```

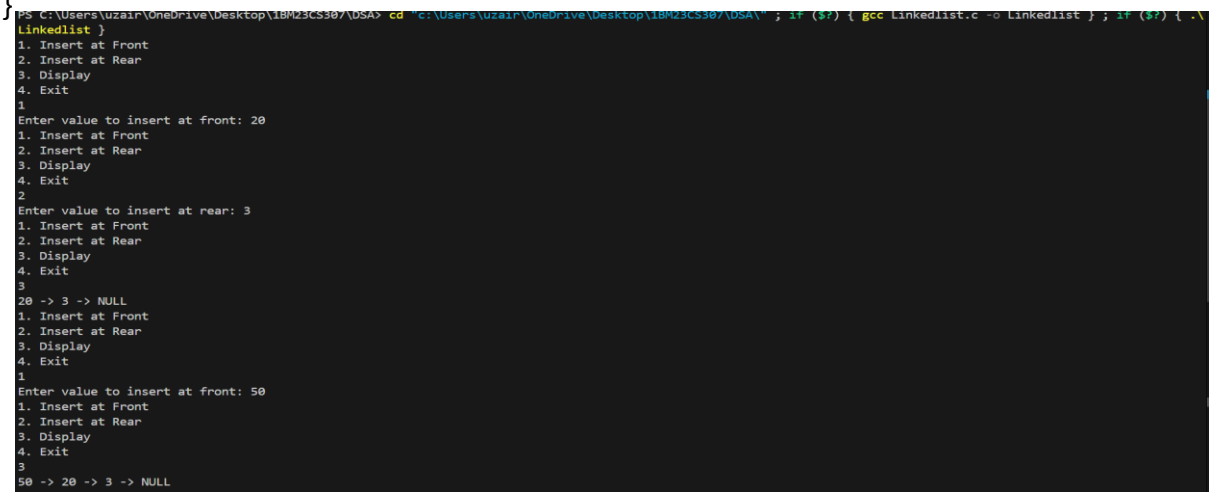


```
    case 4:
        exit(0);
    default:
        printf("Invalid choice. please Try again \n");
    }
}
return 0;
}
```

Code:

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

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

struct Node* createNode(int val) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = val;
    newNode->link = NULL;
    return newNode;
}

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

void insertEnd(struct Node** head, int n) {
    struct Node* temp = createNode(n);
    if (*head == NULL) {
        *head = temp;  // If the list is empty, the new node becomes the head
    } else {
        struct Node* ptr = *head;
        while (ptr->link != NULL) {
            ptr = ptr->link;
        }
        ptr->link = temp;  // Add the new node at the end
    }
}

void insertFront(struct Node** head, int n) {
    struct Node* temp = createNode(n);
    temp->link = *head;
    *head = temp;  // The new node becomes the head of the list
}
```

```c
int main() {
    struct Node* head = NULL;
    int choice, val;

    while (1) {
        printf("1. Insert at Front\n");
        printf("2. Insert at Rear\n");
        printf("3. Display\n");
        printf("4. Exit\n");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter value to insert at front: ");
                scanf("%d", &val);
                insertFront(&head, val);
                break;
            case 2:
                printf("Enter value to insert at rear: ");
                scanf("%d", &val);
                insertEnd(&head, val);
                break;
            case 3:
                display(head);
                break;
            case 4:
                exit(0);
            default:
                printf("Invalid choice. Please try again.\n");
        }
    }
    return 0;
}
```



```c
#include <string.h>

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

Leet Code Valid Parenthesis

Program 6

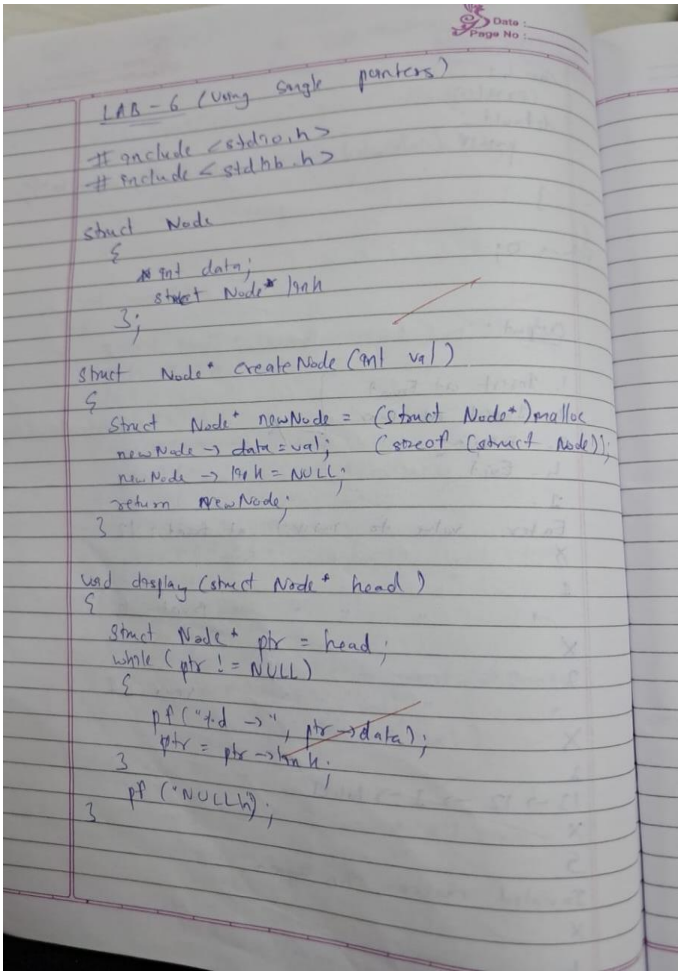
Write a Program to Implement Singly Linked List with following operations

a) Create a linked list.

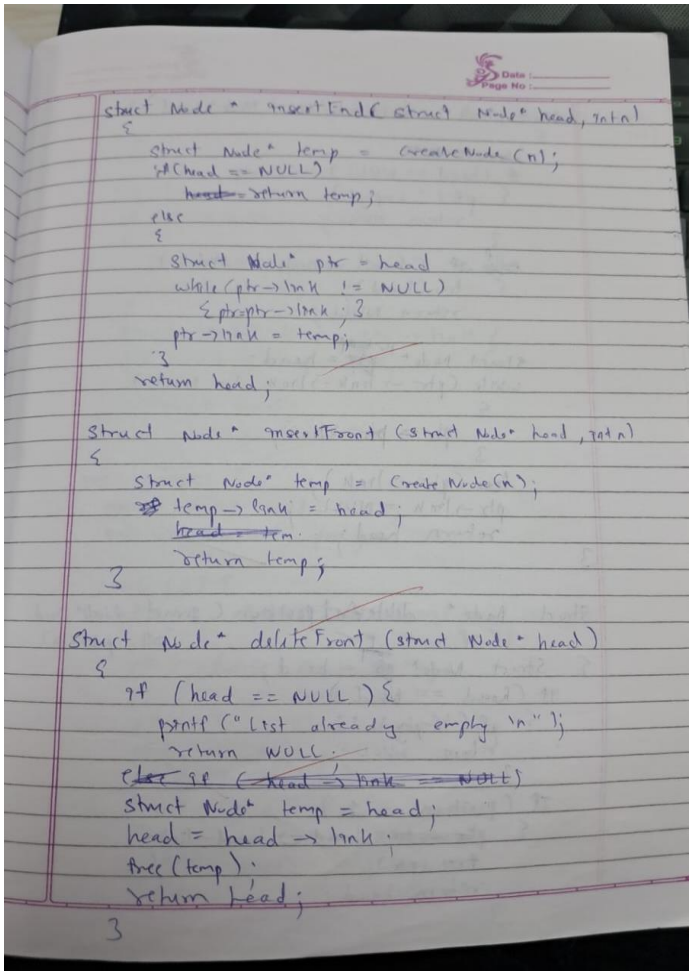
b) Deletion of first element, specified element and last element in the list.

c) Display the contents of the linked list.

Leetcode Problem -- 739 (Daily Temperature)



```
LAB - 6 (Using Single pointers)

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

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

struct Node* createNode (int val)
{
    struct Node* newNode = (struct Node*)malloc
    newNode -> data = val;   (sizeof (struct Node));
    newNode -> link = NULL;
    return newNode;
}

void display (struct Node* head)
{
    struct Node* ptr = head;
    while (ptr != NULL)
    {
        pf ("%d ->", ptr -> data);
        ptr = ptr -> link;
    }
    pf ("NULL\n");
}
```



```
struct Node * insertEnd( struct Node* head, int n)
{
    struct Node* temp = createNode (n);
    if(head == NULL)
        return temp;
    else
    {
        struct Node* ptr = head
        while(ptr -> link != NULL)
            {ptr=ptr -> link ;}
        ptr -> link = temp;
    }
    return head;
}

struct Node * insertFront (struct Node* head, int n)
{
    struct Node* temp = createNode(n);
    temp -> link = head;
        return temp;
}

struct Node* deleteFront (struct Node* head)
{
    if (head == NULL ){
        printf ("List already empty \n");
        return NULL;
    else if (head -> link == NULL)
    struct Node* temp = head;
    head = head -> link;
    free (temp);
    return head;
}
```

```
struct Node * deleteEnd (struct Node * head)
{
    if (head == NULL)
    { printf ("Empty");
      return NULL;
    }
    if (head -> link == NULL)
    { free (head);
      return NULL;
    }
    struct Node * ptr = head;
    while (ptr -> link -> link != NULL)
    {
        ptr = ptr -> link;
    }
    free (ptr -> link);
    ptr -> link = NULL;
    return head;
}

struct Node * deleteAtposition (struct Node * head,
                                int position)
{ struct Node * ptr = head;
  if (head == NULL)
  { printf ("Empty \n");
    return NULL;
  }
  if (position == 1)
  { ptr = head -> link;
    free (ptr);
    return head;
  }
}
```

```
for (int i=1; i< position-1 && ptr->link != NULL; i++)
{
    ptr = ptr->link;
}
if (ptr->link == NULL)
{
    pf("Out of bounds.\n");
    return head;
}
struct Node* temp = ptr->link;
ptr->link = temp->link;
free(temp);
return head;
}

int main() {
    struct Node* head = NULL;
    int choice, val, pos;

    while (1) {
        pf("1. Insert at Front\n");
        pf("2.      "  "  Rear\n");
        pf("3. Delete Front\n");
        pf("4.      "  Rear\n");
        pf("5.      "  at Position\n");
        pf("6. Display\n");
        pf("7. Exit\n");
        scanf("%d", &choice);

        switch(choice)
        {
```

```
case 1:
    printf("Enter value to insert at front:");
    scanf("%d", &val);
    head = insertFront(head, val);
    break;

case 2:
    pf("                    insert at rear:");
    scanf(_____);
    head = insertEnd(head, val);
    break;

case 3:
    head = deleteFront(head);
    break;

case 4:
    head = deleteEnd(head);
    break;

case 5:
    printf("Enter position to delete:");
    scanf("%d", &pos);
    head = deleteAtPosition(head, pos);
    break;
case 6:
    display(head);
    break;
case 7:
    exit(0);
default:
    printf("\n Invalid choice. Try Again.\n")
}
return 0;
```

Code:

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

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

// Function to create a new node
struct Node* createNode(int val) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = val;
    newNode->link = NULL;
    return newNode;
}

// Function to display the linked list
void display(struct Node* head) {
    struct Node* ptr = head;
    while (ptr != NULL) {
        printf("%d -> ", ptr->data);
        ptr = ptr->link;
    }
    printf("NULL\n");
}

// Function to insert at the end of the list
struct Node* insertEnd(struct Node* head, int n) {
    struct Node* temp = createNode(n);

    if (head == NULL) {
        return temp;  // If the list is empty, the new node becomes the head
    } else {
        struct Node* ptr = head;
        while (ptr->link != NULL) {
            ptr = ptr->link;
        }
        ptr->link = temp;  // Add the new node at the end
    }
    return head;
}

// Function to insert at the front of the list
struct Node* insertFront(struct Node* head, int n) {
    struct Node* temp = createNode(n);
    temp->link = head;  // The new node points to the current head
    return temp;        // Return the new node as the new head of the list
```

```
}

// Function to delete the front node
struct Node* deleteFront(struct Node* head) {
    if (head == NULL) {
        printf("The list is already empty.\n");
        return NULL;
    }
    struct Node* temp = head;
    head = head->link;   // Move head to the next node
    free(temp);          // Free the old head
    return head;
}

// Function to delete the end node
struct Node* deleteEnd(struct Node* head) {
    if (head == NULL) {
        printf("The list is already empty.\n");
        return NULL;
    }
    if (head->link == NULL) { // Only one node in the list
        free(head);
        return NULL;
    }
    struct Node* ptr = head;
    while (ptr->link->link != NULL) {
        ptr = ptr->link;
    }
    free(ptr->link);      // Free the last node
    ptr->link = NULL;     // Set the second last node's link to NULL
    return head;
}

// Function to delete a node at a specified position
struct Node* deleteAtPosition(struct Node* head, int position) {
    struct Node* ptr = head;
    if (head == NULL) {
        printf("The list is empty.\n");
        return NULL;
    }
    if (position == 1) { // Delete the first node
        head=head->link;
        free(ptr);
        return head;
    }
    for (int i = 1; i < position - 1 && ptr->link != NULL; i++) {
        ptr = ptr->link;
    }
    if (ptr->link == NULL) {
```

```
        printf("Position out of bounds.\n");
        return head;
    }
    struct Node* temp = ptr->link;
    ptr->link = temp->link;
    free(temp);          // Free the node at the specified position
    return head;
}

int main() {
    struct Node* head = NULL;
    int choice, val, pos;

    while (1) {
        printf("1. Insert at Front\n");
        printf("2. Insert at Rear\n");
        printf("3. Delete Front\n");
        printf("4. Delete Rear\n");
        printf("5. Delete at Position\n");
        printf("6. Display\n");
        printf("7. Exit\n");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter value to insert at front: ");
                scanf("%d", &val);
                head = insertFront(head, val);
                break;
            case 2:
                printf("Enter value to insert at rear: ");
                scanf("%d", &val);
                head = insertEnd(head, val);
                break;
            case 3:
                head = deleteFront(head);
                break;
            case 4:
                head = deleteEnd(head);
                break;
            case 5:
                printf("Enter position to delete: ");
                scanf("%d", &pos);
                head = deleteAtPosition(head, pos);
                break;
            case 6:
                display(head);
                break;
            case 7:
```

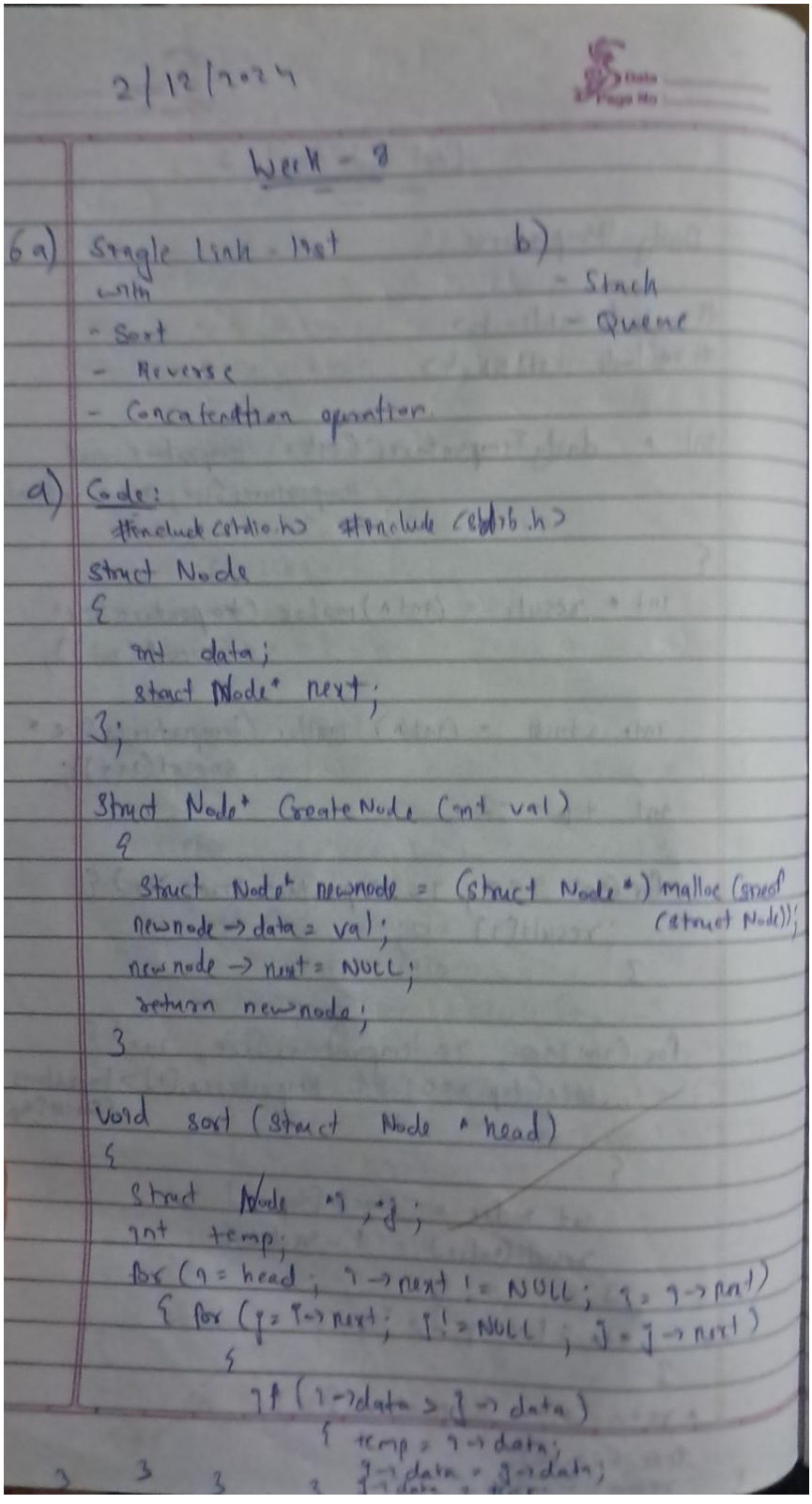
```
            exit(0);
        default:
            printf("Invalid choice. Please try again.\n");
    }
  }
  return 0;
}
```

```c
/**
 * Note: The returned array must be malloced, assume caller calls free().
 */
int* dailyTemperatures(int* temperatures, int temperaturesSize, int* returnSize) {
    *returnSize = temperaturesSize;
    int* answer = (int*)calloc(temperaturesSize, sizeof(int));
    int* stack = (int*)malloc(temperaturesSize * sizeof(int));
    int top = -1;

    for (int i = 0; i < temperaturesSize; i++) {
        while (top !=-1 && temperatures[i] > temperatures[stack[top]]) {
            int j = stack[top--];
            answer[j] = i - j;
        }
        stack[++top] = i;

    free(stack);
    return answer;

}
```

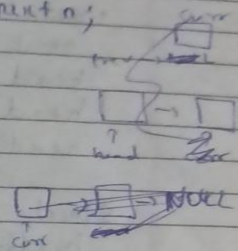
Leet Code Daily Temperatures

Program 7

a) Write a Program to Implement Single Link List with following operations:
(i)Sort the linked list,
(ii) Reverse the linked list,
(iii)Concatenation of two linked lists.



```
Struct Node *
reverse (struct Node * head)
{
    Struct Node *prev, *curr, *nextn;
    prev = NULL;
    curr = head;
    nextn = head;

    while (nextn != NULL)
    {
        nextn = nextn -> next;
        curr -> next = prev;
        prev = curr;
        curr = nextn;
    }
    return prev;
}

Struct Node*
Concat (struct Node *head1, struct Node *head2)
{   if (head1 == NULL) return head2;
    Struct Node *temp2;
    temp1 = head1;
    while (temp1 -> next != NULL)
    {
        temp1 = temp1 -> next
    }
    temp1 -> next = head2;
```



```
Void display (struct Node * head)
{
    struct Node * ptr = head;
    while (ptr != NULL)
    { pf ("%d -> " ptr -> data);
      ptr = ptr -> next; }
    pf ("NULL \n");
}
Void main ()
{
    struct Node * head = NULL;
    head -> data = 4;
    head -> next = CreateNode (2);
    head -> next -> next = CreateNode (9);
    head -> next -> next -> next = CreateNode (1);

    Struct Node * head2 = NULL;
    head2 -> data = 5;
    head2 -> next = CreateNode (3);
    head2 -> next -> next = CreateNode (8);

    display (head);
    display (head2);

    sort (head);
    display (head);

    head2 = reverse (head2);
    display (head2);

    head = Concat (head, head2);
    display (head);
}
```

Code:

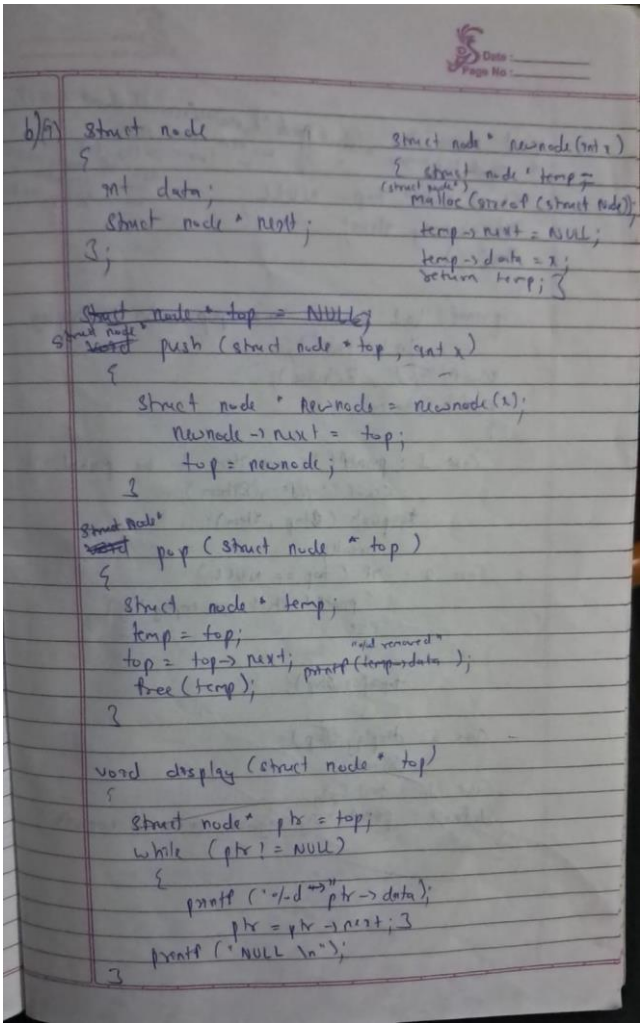
```
#include <stdio.h>
#include <stdlib.h>

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

struct Node* CreateNode(int val) {
    struct Node* newnode = (struct Node*)malloc(sizeof(struct Node));
    newnode->data = val;
    newnode->next = NULL;
    return newnode;
}

void sort(struct Node* head) {
    struct Node *i, *j;
    int temp;
    for (i = head; i != NULL; i = i->next) {
        for (j = i->next; j != NULL; j = j->next) {
            if (i->data > j->data) {
                temp = i->data;
                i->data = j->data;
                j->data = temp;
            }
        }
    }
}

struct Node* reverse(struct Node* head) {
    struct Node *prev = NULL, *curr = head, *nextn = NULL;
    while (curr != NULL) {
        nextn = curr->next;
        curr->next = prev;
        prev = curr;
        curr = nextn;
    }
    return prev;
}

struct Node* Concat(struct Node* head1, struct Node* head2) {
    if (head1 == NULL) return head2;

    struct Node* temp1 = head1;
    // Traverse to the last node of the first list
```

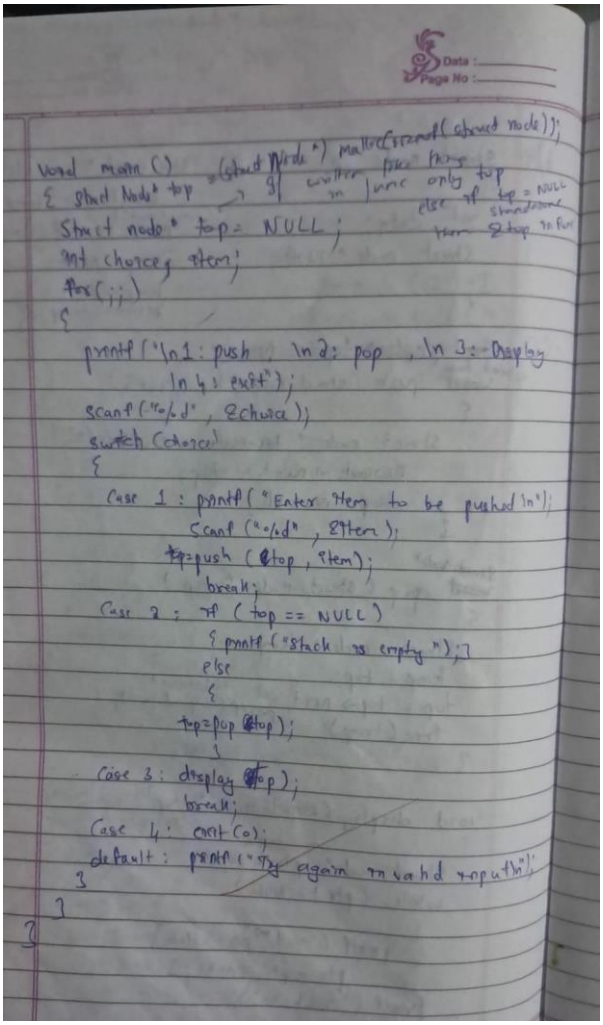
```
    while (temp1->next != NULL) {
        temp1 = temp1->next;
    }
    temp1->next = head2;
    return head1;
}

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

int main() {
    struct Node* head = CreateNode(4);
    head->next = CreateNode(2);
    head->next->next = CreateNode(9);
    head->next->next->next = CreateNode(1);

    struct Node* head2 = CreateNode(5);
    head2->next = CreateNode(3);
    head2->next->next = CreateNode(8);
    display(head);
    display(head2);

    sort(head);
    display(head);

    head2 = reverse(head2);
    display(head2);

    head = Concat(head, head2);
    display(head);

    return 0;
}
```

```
PS C:\Users\uzair\OneDrive\Desktop\1BM23CS307> cd "c:\Users\uzair\OneDrive\Desktop\1BM23CS307\DSA\Lab 8\" ;
if ($?) { gcc SLLOperations.c -o SLLOperations } ; if ($?) { .\SLLOperations }
4 ->2 ->9 ->1 ->NULL
5 ->3 ->8 ->NULL
1 ->2 ->4 ->9 ->NULL
8 ->3 ->5 ->NULL
1 ->2 ->4 ->9 ->8 ->3 ->5 ->NULL
PS C:\Users\uzair\OneDrive\Desktop\1BM23CS307\DSA\Lab 8>
```

Output

b)Write a Program to Implement Single Link List to simulate
(i)Stack
(ii)Queue Operations.



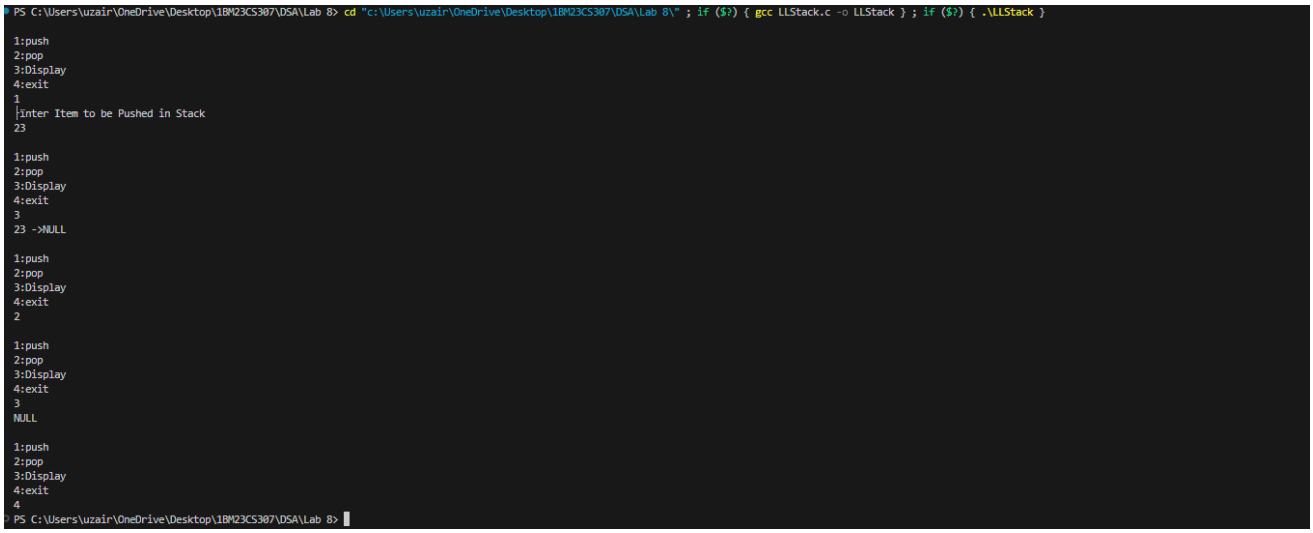


(i) Code:

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

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

struct Node* CreateNode(int val) {
```

```
    struct Node* newnode = (struct Node*)malloc(sizeof(struct Node));
    newnode->data = val;
    newnode->next = NULL;
    return newnode;
}


struct Node* push(struct Node*top,int x)
{
    struct Node* newnode = CreateNode(x);
    newnode->next = top;
    top = newnode;
    return newnode;
}

struct Node* pop(struct Node* top)
{
    struct Node* temp;
    temp = top;
    top = top->next;
    free(temp);
    return top;

}

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

void main()
{
    struct Node* top = (struct Node*)malloc(sizeof(struct Node));
    top = NULL;
    int choice,item;
    for(;;)
    {
        printf("\n1:push \n2:pop \n3:Display \n4:exit\n");
        scanf("%d",&choice);
        switch (choice)
        {
        case 1:
            printf("Ënter Item to be Pushed in Stack \n");
            scanf("%d",&item);
            top = push(top,item);
```

```
            break;
        case 2:
            if (top == NULL)
            {
                printf("Stack is Empty");
            }
            else
            {
                top =pop(top);
            }
            break;
        case 3:
            display(top);
            break;
        case 4:
            exit(0);
        default:
        printf("Try again invalid input \n");
        break;
        }
    }
}
```



Output (i)

```
(ii) struct node
{ same as
  stack
}

struct node* newnode (int x)
{
  Same as stack
}
struct node*
void dequeue ( struct node * front , struct node* rear)
{
  struct node * temp = front;
  temp = front;
  if (front == NULL  && rear == NULL)
      printf ("Underflow \n"); return NULL;
  else if (front == rear)
  { temp = front;
    front = NULL;
    rear = NULL;
    printf ("%d removed", temp -> data);
    free (temp);
  }
  else
  {
    front = front -> next;
    free (temp);
    return front;
  }
}
```

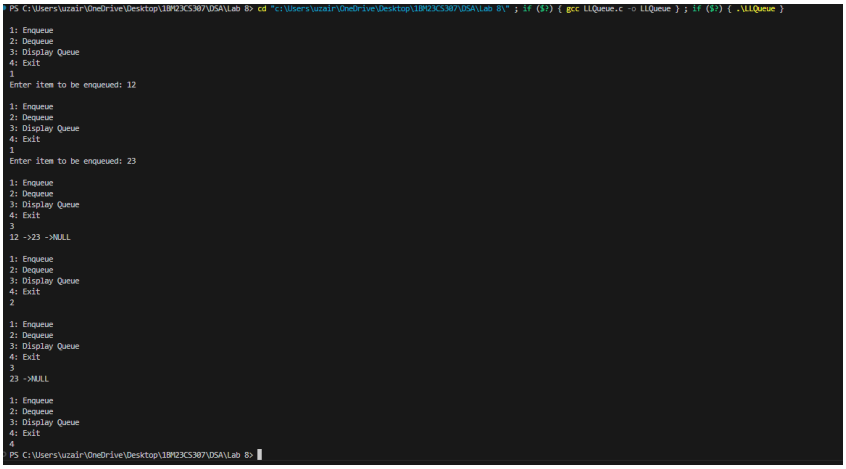
```
struct node*
void enque ( struct node* front , struct node* rear,
                int x)
{
  struct node* temp = newnode(x);
  if (front == NULL && rear == NULL)
  {
    front = temp; return temp;
    rear = temp;
    return;
  }
  else
  {
    rear -> next = temp;
    rear = temp;
    rear = temp; rear
    return newnode temp;
  }
}

                    struct node* front
void display()
{
  same as stack;
}

void front ()
                    struct node * front
{
  pf ("%d", front -> data);
}

                    struct node * rear
void rear()
{ printf ("%d", rear -> data);
```

```
Void main ()
{
  Struct node* front = NULL;
  Struct node * rear = NULL;
  int choice, data;
  for (;;)
  {
    printf ("\n 1: enque , \n 2: deque \n 3: Display
          \n 4: front \n 5: Rear \n 6: exit");
    Scanf ("%d", &choice);
    switch (choice)
    {
      Case 1 : printf ("Enter item to enque ");
               Scanf ("%d", &data);
               rear=enque ( front, rear, data);
               break;
      Case 2 : front = deque (front, rear)
               if (front == NULL) { front = rear = NULL; }
               break;
      Case 3: display (front);
               break;
      Case 4: front(front);
               break;
      Case 5 : rear(rear);
               break;
      Case 6 : exit(0);
      default : printf (" Try again invalid input");
    }
  }
}
```

(ii) Code:

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

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

struct Node* CreateNode(int val) {
    struct Node* newnode = (struct Node*)malloc(sizeof(struct Node));
    newnode->data = val;
    newnode->next = NULL;
    return newnode;
}

struct Node* enqueue(struct Node* rear, int x) {
    struct Node* newnode = CreateNode(x);
    if (rear == NULL) {
        return newnode;
    }
    rear->next = newnode;
    return newnode;
}

struct Node* dequeue(struct Node* front) {
    if (front == NULL) {
        printf("Queue is empty\n");
        return NULL;
    }
    struct Node* temp = front;
    front = front->next;
    free(temp);
    return front;
}

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

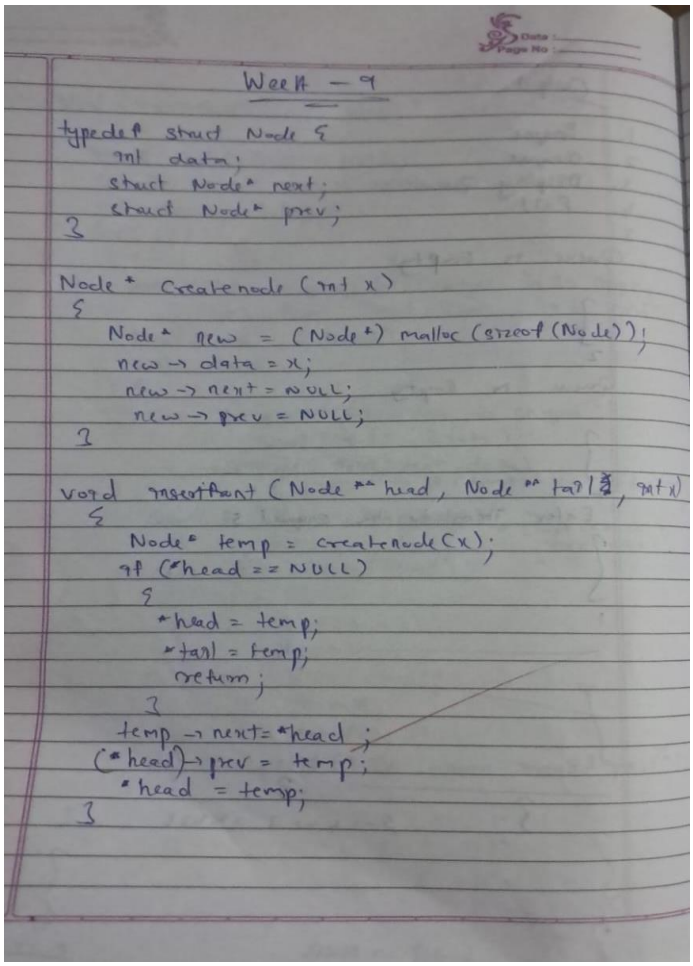
```
int main() {
    struct Node* front = NULL;
    struct Node* rear = NULL;
    int choice, item;

    for (;;) {
        printf("\n1: Enqueue\n2: Dequeue\n3: Display Queue\n4: Exit\n");
        scanf("%d", &choice);

        switch (choice) {
        case 1:
            printf("Enter item to be enqueued: ");
            scanf("%d", &item);
            rear = enqueue(rear, item);  // Enqueue operation, rear updated
            if (front == NULL) {
                front = rear;
            }
            break;
        case 2:
            front = dequeue(front);  // Dequeue operation, front updated
            if (front == NULL) {
                rear = NULL;
            }
            break;
        case 3:
            display(front);
            break;
        case 4:
            exit(0);  // Exit the program
        default:
            printf("Invalid input. Please try again.\n");
            break;
        }
    }
}
```



Output (ii)

Program 8

Write a Program to Implement doubly link list with primitive operations
a) Create a doubly linked list.
b) Insert a new node at the beginning.
c) Insert the node based on a specific location
d) Insert a new node at the end.
e) Display the contents of the list



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

Node * Createnode (int x)
{
    Node* new = (Node*) malloc (sizeof (Node));
    new -> data = x;
    new -> next = NULL;
    new -> prev = NULL;
}

void insertfront (Node ** head, Node ** tail, int x)
{
    Node* temp = createnode(x);
    if (*head == NULL)
    {
        *head = temp;
        *tail = temp;
        return;
    }
    temp -> next = *head;
    (*head) -> prev = temp;
    *head = temp;
}
```
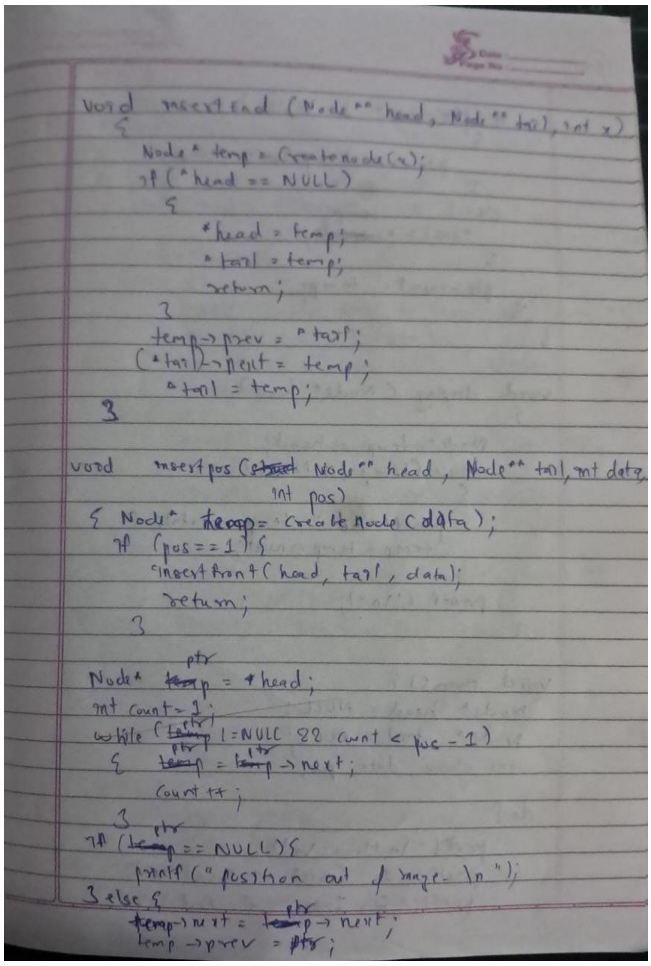
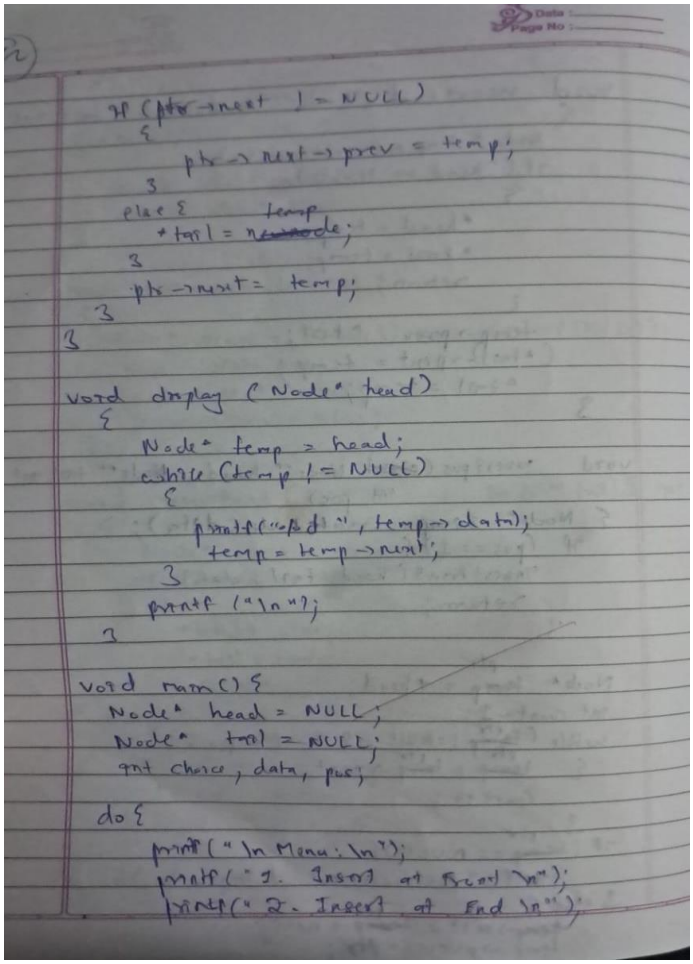
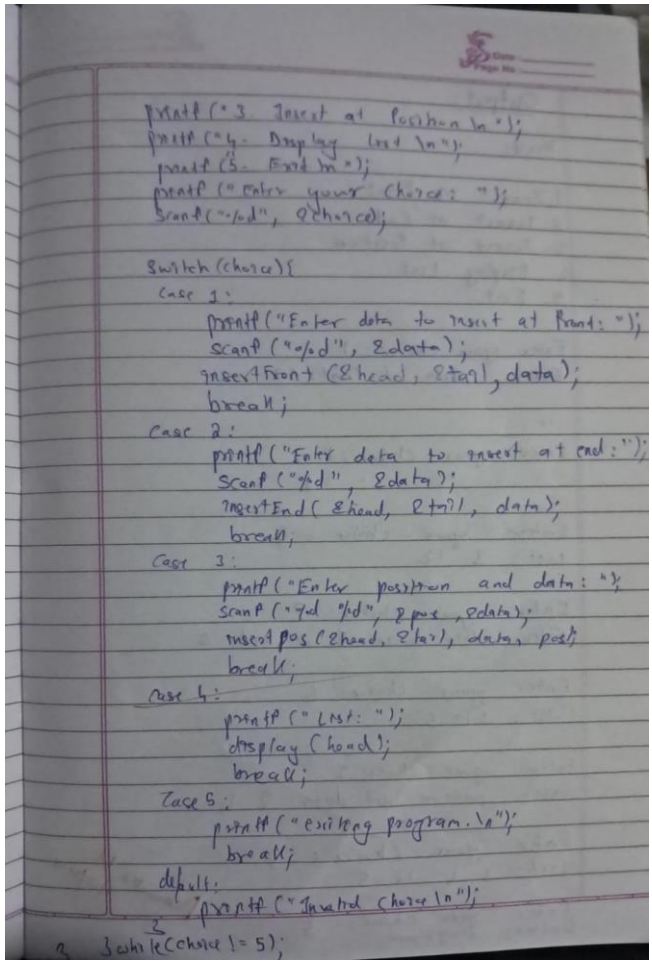



```
void insertend (Node** head, Node** tail, int x)
{
    Node* temp = Createnode(x);
    if (*head == NULL)
    {
        *head = temp;
        *tail = temp;
        return;
    }
    temp -> prev = *tail;
    (*tail) -> next = temp;
    *tail = temp;
}

void insertpos (Node** head, Node** tail, int data,
                int pos)
{ Node* temp = Create Node (data);
  if (pos == 1) {
      insertfront (head, tail, data);
      return;
  }
  Node* ptr = *head;
  int count = 1;
  while (ptr != NULL && count < pos - 1)
  { ptr = ptr -> next;
    count ++;
  }
  if (ptr == NULL){
      printf ("position out of range- \n");
  } else {
      temp -> next = ptr -> next;
      temp -> prev = ptr;
```



```
if (ptr->next != NULL)
{
    ptr->next->prev = temp;
}
else {
    *tail = temp;
}
ptr->next = temp;
}

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

void main() {
    Node* head = NULL;
    Node* tail = NULL;
    int choice, data, pos;

    do {
        printf("\n Menu:\n");
        printf("1. Insert at Front\n");
        printf("2. Insert at End\n");
```



```
printf("3. Insert at Position\n");
printf("4. Display List\n");
printf("5. Exit\n");
printf("Enter your choice: ");
scanf("%d", &choice);

switch(choice){
case 1:
    printf("Enter data to insert at Front: ");
    scanf("%d", &data);
    insertFront(&head, &tail, data);
    break;
case 2:
    printf("Enter data to insert at end: ");
    scanf("%d", &data);
    insertEnd(&head, &tail, data);
    break;
case 3:
    printf("Enter position and data: ");
    scanf("%d %d", &pos, &data);
    insertPos(&head, &tail, data, pos);
    break;
case 4:
    printf("List: ");
    display(head);
    break;
case 5:
    printf("exiting program.\n");
    break;
default:
    printf("Invalid choice\n");
}
} while(choice != 5);
```

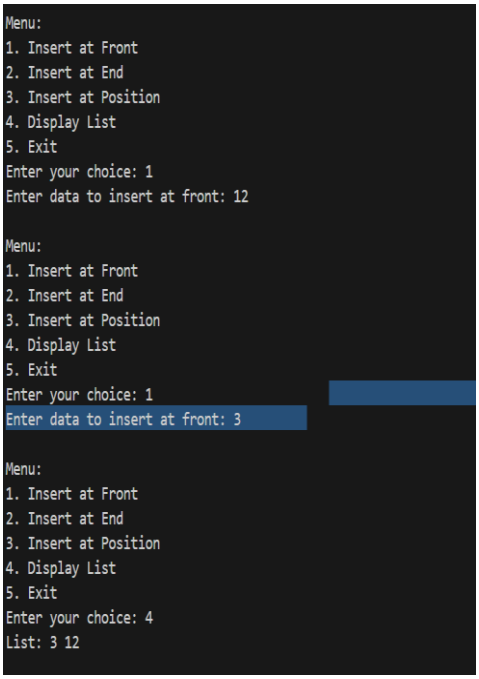
Code:

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


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


Node* createNode(int data) {
    Node* temp = (Node*)malloc(sizeof(Node));
    temp->data = data;
    temp->prev = NULL;
    temp->next = NULL;
    return temp;
}


void insertFront(Node** head, Node** tail, int data) {
    Node* temp = createNode(data);
    if (*head == NULL) {
```

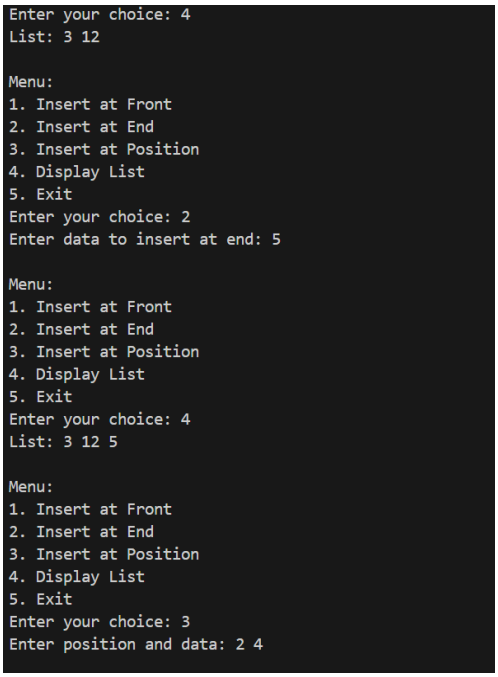
```
        *head = *tail = temp;
    } else {
        temp->next = *head;
        (*head)->prev = temp;
        *head = temp;
    }
}


void insertEnd(Node** head, Node** tail, int data) {
    Node* temp = createNode(data);
    if (*tail == NULL) {
        *head = *tail = temp;
    } else {
        (*tail)->next = temp;
        temp->prev = *tail;
        *tail = temp;
    }
}


void insertAtPos(Node** head, Node** tail, int data, int pos) {
    Node* temp = createNode(data);


    if (pos == 1) {
        insertFront(head, tail, data);
        return;
    }

    Node* ptr = *head;
    int count = 1;
    while (ptr != NULL && count < pos - 1) {
        ptr = ptr->next;
        count++;
    }

    if (ptr == NULL) {
        printf("Position out of range.\n");
    } else {
        temp->next = ptr->next;
        temp->prev = ptr;

        if (ptr->next != NULL) {
            ptr->next->prev = temp;
        } else {
            *tail = temp;
        }
        ptr->next = temp;
```

```
    }
}


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


int main() {
    Node* head = NULL;
    Node* tail = NULL;
    int choice, data, pos;

    do {
        printf("\nMenu:\n");
        printf("1. Insert at Front\n");
        printf("2. Insert at End\n");
        printf("3. Insert at Position\n");
        printf("4. Display List\n");
        printf("5. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter data to insert at front: ");
                scanf("%d", &data);
                insertFront(&head, &tail, data);
                break;
            case 2:
                printf("Enter data to insert at end: ");
                scanf("%d", &data);
                insertEnd(&head, &tail, data);
                break;
            case 3:
                printf("Enter position and data: ");
                scanf("%d %d", &pos, &data);
                insertAtPos(&head, &tail, data, pos);
                break;
            case 4:
                printf("List: ");
                printList(head);
                break;
```

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

    return 0;
}
```



Output 1



Output 2

Output 3