VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

Data Structures using C Lab

(23CS3PCDST)

Submitted by

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in partial fulfilment 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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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 **Sharada Koundinya(1BM23CS310),** who is bona fide student of **B.M.S. College of Engineering.** It is in partial fulfilment 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 academic requirements in respect of Data Structures using C Lab (23CS3PCDST) work prescribed for the said degree.

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Github Link:
https://github.com/sharadakoundinya/1BM23CS310_sharadakoundinya_dslab

Program 1

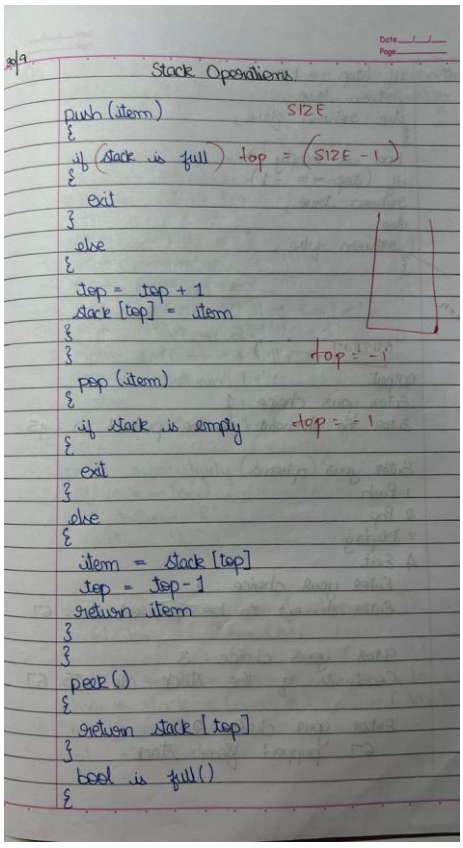
Write a program to simulate the working of stack using an array with the following:
a) Push
b) Pop
c) Display
The program should print appropriate messages for stack overflow, stack underflow

Code:

```
#include<stdio.h>
#include<stdlib.h>
#define size 5

int top=-1;
int stack[size];
int item;

void push(){
   if(top==size-1){
      printf("Stack Overload\n");
   }
   else{
      top+=1;
      stack[top]=item;
   }
}

int pop(){
   if(top==-1){
      printf("Stack Underflow\n");
   }
   else{
      return stack[top--];
   }
}

void display(){
   if(top==-1){
      printf("Stack is empty!");
   }
```

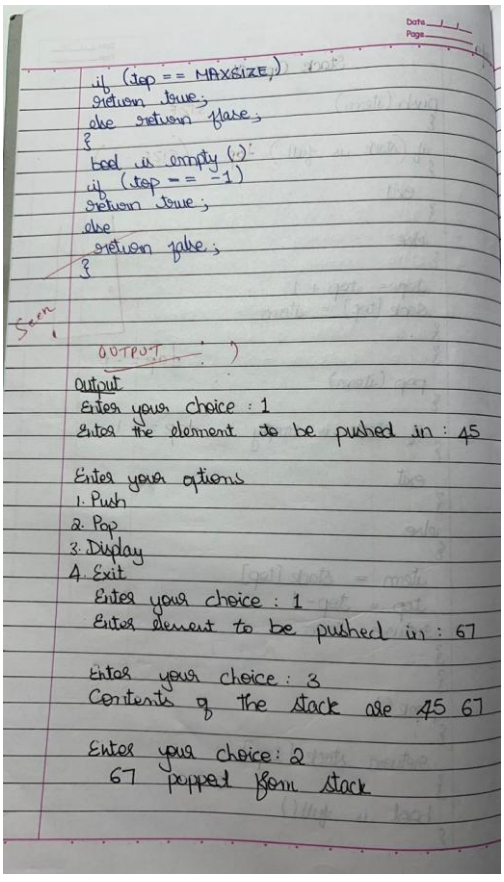
```
    else{
        printf("Content of the stacks:");
        for(int i=0;i<=top;i++){
            printf("%d ",stack[i]);
        }printf("\n");
    }
}

void main(){
    int choice;
    while(1){
        printf("Enter your options:\n");
        printf("1.Push\n2.Pop\n3.Display\n4.Exit\n");
        printf("Enter your choice:");
        scanf("%d",&choice);
        switch(choice){
            case 1:printf("Enter the element to be pushed in:");scanf("%d",&item);push();break;
            case 2:if(top==-1){
                printf("stack is empty!\n");
            }else{
                printf("%d popped from stack\n", stack[top]);
            }
            pop();
            break;
            case 3:display();
            break;
            case 4:exit(0);
        }
    }
}
```

```
Enter your choice:1
Enter the element to be pushed in:45
Enter your options:
1.Push
2.Pop
3.Display
4.Exit
Enter your choice:1
Enter the element to be pushed in:67
Enter your options:
1.Push
2.Pop
3.Display
4.Exit
Enter your choice:3
Content of the stacks:45 67
Enter your options:
1.Push
2.Pop
3.Display
4.Exit
Enter your choice:2
67 popped from stack
Enter your options:
1.Push
2.Pop
3.Display
4.Exit
Enter your choice:
```



Stack Operations

```
push (item)                    SIZE
{
if (stack is full) top = (SIZE - 1)
{
  exit
}
else
{
  top = top + 1
  stack [top] = item
}
}                              top = -1
pop (item)
{
 if stack is empty   top = -1
{
  exit
}
else
{
  item = stack [top]
  top = top - 1
  return item
}
}
peek()
{
 return stack [top]
}
bool is full()
{
```



```
if (top == MAXSIZE)
return true;
else return false;
}
bool is empty ():
if (top == -1)
return true;
else
return false;
}
```

Scan

OUTPUT :)

Output

Enter your choice : 1
Enter the element to be pushed in : 45

Enter your options
1. Push
2. Pop
3. Display
4. Exit

Enter your choice : 1
Enter element to be pushed in : 67

Enter your choice : 3
Contents of the stack are 45 67

Enter your choice: 2
67 popped from stack

Program 2

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

Code:

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

#define MAX 5

char stack[MAX];
int top = -1;

void push(char c) {
   if (top < MAX - 1) {
      stack[++top] = c;
   }
}
char pop() {
   if (top >= 0) {
      return stack[top--];
   }
   return '\0';
}
char peek() {
   if (top >= 0) {
      return stack[top];
   }
   return '\0';
}

int precedence(char c) {
   switch (c) {
      case '+': return 1;
      case '-': return 1;
      case '*': return 2;
      case '/': return 2;
      case '^': return 3;
      default: return 0;
   }
}
```

```
int isOperator(char c) {
    return c == '+' || c == '-' || c == '*' || c == '/'|| c=='^';
}


void infixToPostfix(const char *infix, char *postfix) {
    int i = 0, j = 0;
    while (infix[i]) {
        if (isalnum(infix[i])) {
            postfix[j++] = infix[i];
        } else if (infix[i] == '(') {
            push(infix[i]);
        } else if (infix[i] == ')') {
            while (top != -1 && peek() != '(') {
                postfix[j++] = pop();
            }
            pop();
        } else if (isOperator(infix[i])) {
            while (top != -1 && precedence(peek()) >= precedence(infix[i])) {
                postfix[j++] = pop();
            }
            push(infix[i]);
        }
        i++;
    }
    while (top != -1) {
        postfix[j++] = pop();
    }
    postfix[j] = '\0';
}

int main() {
    char infix[MAX], postfix[MAX];

    printf("Enter an infix expression: ");
    scanf("%s", infix);

    infixToPostfix(infix, postfix);
    printf("Postfix expression: %s\n", postfix);

    return 0;
}
```

```
Enter an infix expression: abcd^e-fgh*+^*+i-
Postfix expression: abcde^fgh*-^*+i+-
```

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Q2 WAP to convert a given valid parenthesized infix arithmetic expression to postfix expression.

```
#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 = (char *) malloc (len+1);
char *stack = (char *) malloc (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[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);

free(result);
free(stack); }

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

output

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

Namrata. M
7Alpha4

Program 3a

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

Code:

```
#include <stdio.h>
#define max_size 4
int queue [max_size];
int front =-1;
int rear=-1;

void insert(int value){
   if (rear==max_size -1){
      printf("Queue overflow! Cannot insert elements");
   }
   else{
      if(front == -1){
         front =0;
      }

      queue[++rear]=value;
      printf("Insert %d into queue",value);
   }
}

void delete(){
   if(front==-1 || front>rear){
      printf("Queue underflow!Cannot delete ");
   }
   else{
      printf("Deleted %d from the queue",queue[front]);
      front++;
   }
}

void display(){
   if (front==-1 || front>rear){
      printf("Queue is empty");
   }
   else{
      printf("Queue Elements\n");
      for(int i=front;i<=rear;i++){
         printf("%d ",queue[i]);
      }
```

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

int main(){
    int choice, value;
    while(1){
        printf("\n1.Insert");
        printf("\n2.Delete");
        printf("\n3.Display");
        printf("\n4.Exit");
        printf("\nEnter your choice:");
        scanf("%d",&choice);
        switch (choice){
            case 1: printf("Enter a value to insert:");
                    scanf("%d",&value);
                    insert(value);
                    break;
            case 2: delete();
            break;
            case 3: display();
            break;
            case 4: return 0;
            default: printf("Invalid choice! Please try again\n");
        }
    }
```

```
Enter your choice:1
Enter a value to insert:4
Insert 4 into queue
1.Insert
2.Delete
3.Display
4.Exit
Enter your choice:1
Enter a value to insert:5
Insert 5 into queue
1.Insert
2.Delete
3.Display
4.Exit
Enter your choice:1
Enter a value to insert:9
Insert 9 into queue
1.Insert
2.Delete
3.Display
4.Exit
Enter your choice:3
Queue Elements
4 5 9

1.Insert
2.Delete
3.Display
4.Exit
Enter your choice:4
```

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Pg3 WAP to simulate the working of a queue of integers using an array

```
int queue [MAX];
int front, rear = -1;
int isfull()
{
return rear == max-1;
}
int empty()
{
return front == -1; || front > rear;
}
void enqueue (int value)
{
if (isfull())
{
printf ("Queue overflow")
}
if (front == -1)
{
front = 0;
}
rear ++;
queue [rear] = value;
pf (" %d inserted to queue ", value);
}

void dequeue
{
if (isempty())
{
pf ("Queue is empty");
pf (" % deleted from queue," queue[front]);
front ++;

if front > rear
{
front = rear = -1;
}
}

void display ()
{
if (isempty())
{
Pf ("Queue is empty")
}
Pf (" Queue elements : ")
for (int i = front ; i <= rear; i++)
{
Pf (" %d ", queue [i])

int main()
{
int choice, value;
do {
printf (" Queue operations");

printf (" 1. insert ")
Pf (" 2. delete ")
Pf ("3. display")
Pf ("4. exit")
Pf (" Enter your choice")
scanf (" %d ", &choice);

switch (choice)
{
case 1 : Pf (" Enter value to insert ");
if (" %d ", &value);
enqueue (value);
break;

case 2 : dequeue();
break;

case 3 : display();
break;

case 4 : Pf (" Exiting ")
break;

default :
printf (" Invalid choice ");
}

while (choice != 4)
return 0;
}
```

Output

Queue operations
1. Insert
2. Delete
3. Display
4. Exit

display: Enter your choice : 3
Queue is empty!

insertion: Enter your choice : 1
Enter the value to insert : 3
3 inserted into the queue

deletion: Enter your choice : 2
3 deleted from queue

Enter your choice : 3
Queue elements are : 4 5 9

exit: Enter your choice : 4
Exiting

overflow: Enter value to insert = 9
Queue overflow! cannot insert 9

Navaneeta M.

Program 3b

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

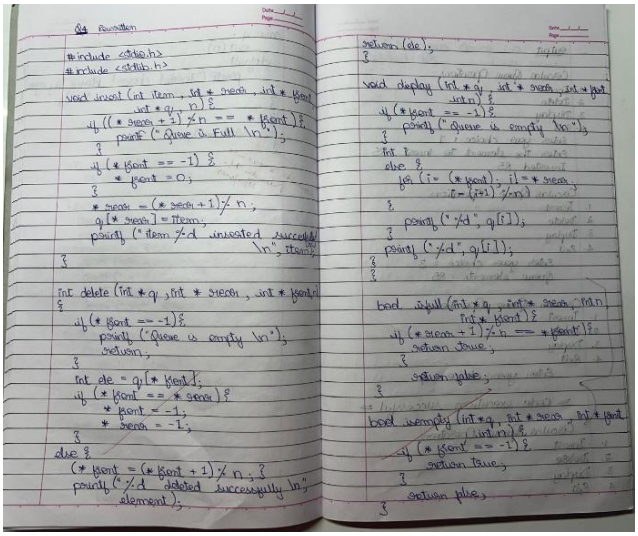
Code:

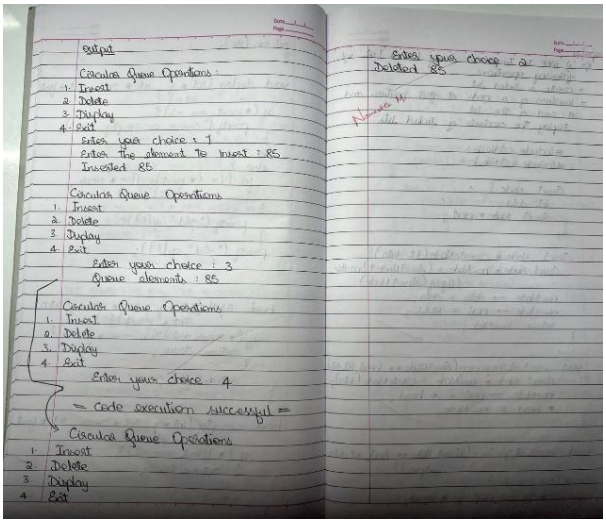
```
#include <stdio.h>
#include <stdlib.h>
#define MAX 5

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

int isFull() {
   return (front == (rear + 1) % MAX);
}

int isEmpty() {
   return (front == -1);
}

void insert(int value) {
   if (isFull()) {
      printf("Queue Overflow: Unable to insert %d\n", value);
      return;
   }
   if (isEmpty()) {
      front = 0; // Set front to 0 if the queue is empty
   }
   rear = (rear + 1) % MAX;
   queue[rear] = value;
   printf("Inserted %d into the queue\n", value);
}

void delete() {
   if (isEmpty()) {
      printf("Queue Underflow: Unable to delete from the queue\n");
      return;
   }
   int deletedValue = queue[front];
   if (front == rear) {
      front = -1; // Queue becomes empty
      rear = -1;
```

```
    } else {
        front = (front + 1) % MAX;
    }
    printf("Deleted %d from the queue\n", deletedValue);
}

void display() {
    if (isEmpty()) {
        printf("Queue is empty\n");
        return;
    }
    printf("Queue elements: ");
    int i = front;
    while (1) {
        printf("%d ", queue[i]);
        if (i == rear) break;
        i = (i + 1) % MAX;
    }
    printf("\n");
}

int main() {
    int choice, value;

    while (1) {
        printf("\nCircular Queue Operations:\n");
        printf("1. Insert\n");
        printf("2. Delete\n");
        printf("3. Display\n");
        printf("4. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter value to insert: ");
                scanf("%d", &value);
                insert(value);
                break;
            case 2:
                delete();
                break;
            case 3:
                display();
                break;
            case 4:
                exit(0);
```

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

    return 0;
}
```

```
Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter value to insert: 85
Inserted 85 into the queue

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter value to insert: 56
Inserted 56 into the queue

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 3
Queue elements: 85 56

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 2
Deleted 85 from the queue
```





Program 4

Write A Program to Implement Singly Linked List with following operations
a) Create a linked list.
b) Insertion of a node at first position, at any position and at end of list.
c) Display the contents of the linked list.

Code:

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

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

void createList(struct Node** head);
void insertAtBeginning(struct Node** head, int data);
void insertAtPosition(struct Node** head, int data, int position);
void insertAtEnd(struct Node** head, int data);
void displayList(struct Node* head);

int main() {
   struct Node* head = NULL;
   int choice, data, position;

   while (1) {
      printf("\nMenu:\n");
      printf("1. Create a linked list\n");
      printf("2. Insert at the beginning\n");
      printf("3. Insert at a specific position\n");
      printf("4. Insert at the end\n");
      printf("5. Display the list\n");
      printf("6. Exit\n");
      printf("Enter your choice: ");
      scanf("%d", &choice);

      switch (choice) {
         case 1:
            createList(&head);
            break;
         case 2:
            printf("Enter data to insert at the beginning: ");
            scanf("%d", &data);
```

```
            insertAtBeginning(&head, data);
            break;
        case 3:
            printf("Enter data to insert: ");
            scanf("%d", &data);
            printf("Enter position to insert (starting from 1): ");
            scanf("%d", &position);
            insertAtPosition(&head, data, position);
            break;
        case 4:
            printf("Enter data to insert at the end: ");
            scanf("%d", &data);
            insertAtEnd(&head, data);
            break;
        case 5:
            displayList(head);
            break;
        case 6:
            printf("Exiting the program.\n");
            exit(0);
        default:
            printf("Invalid choice. Please try again.\n");
      }
   }

   return 0;
}

void createList(struct Node** head) {
   int data, choice;
   do {
      printf("Enter data to insert: ");
      scanf("%d", &data);
      insertAtEnd(head, data);
      printf("Do you want to add another node? (1 for Yes, 0 for No): ");
      scanf("%d", &choice);
   } while (choice != 0);
}

void insertAtBeginning(struct Node** head, int data) {
   struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
   if (newNode == NULL) {
      printf("Memory allocation failed.\n");
      return;
   }
   newNode->data = data;
   newNode->next = *head;
```

```
    *head = newNode;
    printf("Node inserted at the beginning.\n");
}

void insertAtPosition(struct Node** head, int data, int position) {
    if (position < 1) {
        printf("Invalid position.\n");
        return;
    }

    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    if (newNode == NULL) {
        printf("Memory allocation failed.\n");
        return;
    }
    newNode->data = data;

    if (position == 1) {
        newNode->next = *head;
        *head = newNode;
        printf("Node inserted at position %d.\n", position);
        return;
    }

    struct Node* temp = *head;
    for (int i = 1; i < position - 1 && temp != NULL; i++) {
        temp = temp->next;
    }

    if (temp == NULL) {
        printf("Position out of bounds.\n");
        free(newNode);
        return;
    }

    newNode->next = temp->next;
    temp->next = newNode;
    printf("Node inserted at position %d.\n", position);
}

void insertAtEnd(struct Node** head, int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    if (newNode == NULL) {
        printf("Memory allocation failed.\n");
        return;
    }
    newNode->data = data;
```

```
    newNode->next = NULL;

    if (*head == NULL) {
        *head = newNode;
    } else {
        struct Node* temp = *head;
        while (temp->next != NULL) {
            temp = temp->next;
        }
        temp->next = newNode;
    }
    printf("Node inserted at the end.\n");
}

void displayList(struct Node* head) {
    if (head == NULL) {
        printf("The list is empty.\n");
        return;
    }

    printf("Linked list contents: ");
    struct Node* temp = head;
    while (temp != NULL) {
        printf("%d -> ", temp->data);
        temp = temp->next;
    }
    printf("NULL\n");
}
```

```
Menu:
1. Create a linked list
2. Insert at the beginning
3. Insert at a specific position
4. Insert at the end
5. Display the list
6. Exit
Enter your choice: 2
Enter data to insert at the beginning: 12
Node inserted at the beginning.

Menu:
1. Create a linked list
2. Insert at the beginning
3. Insert at a specific position
4. Insert at the end
5. Display the list
6. Exit
Enter your choice: 2
Enter data to insert at the beginning: 23
Node inserted at the beginning.

Menu:
1. Create a linked list
2. Insert at the beginning
3. Insert at a specific position
4. Insert at the end
5. Display the list
6. Exit
Enter your choice: 3
Enter data to insert: 2
Enter position to insert (starting from 1): 2
Node inserted at position 2.
```

```
Menu:
1. Create a linked list
2. Insert at the beginning
3. Insert at a specific position
4. Insert at the end
5. Display the list
6. Exit
Enter your choice: 5
Linked list contents: 23 -> 2 -> 12 -> NULL

Menu:
1. Create a linked list
2. Insert at the beginning
3. Insert at a specific position
4. Insert at the end
5. Display the list
6. Exit
Enter your choice: 6
Exiting the program.
```

28/10/24

Q5. a) WAP to Implement Singly Linked List w/ following operations
→ create a linked list
→ insertion of a node at first position and at end of the list
Display the contents of linked lists

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

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

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

void insert at beginning(structNode ** head, int data)
    struct Node * newNode = createNode(data);
    newNode -> next = * head;
    * head = newNode;
}

void insert at position(struct Node ** head, int data,
                                     int pos){
  if(pos == 1){
  newNode -> next = * head;
    *head = newNode;
    return;
  }
    struct Node * temp = * head;
    for(int i = 1; i < pos-1 && temp!=NULL; i++){
        temp = temp -> next;
  }
     if(temp == NULL){
        printf("Position out of range \n");
     }
     else {
        newNode -> next = temp -> next;
        temp -> next = newNode;
     }
  }
   void insert at end(struct Node ** head,
                      int data){
      struct Node * newNode = createNode
                                    (data);
      if(* head == NULL){
         * head = newNode;
         return;
    }
      struct Node * temp = * head
      while (temp -> next != NULL){
              temp = temp -> next;
      }
       temp -> next = newNode;
    }
void display(structNode * head){
       if(head == NULL){
         printf("Empty list! \n");
         return;
    }
    struct Node * temp = head;
    while(temp != NULL){
      printf("%d -> ", temp -> data);
        temp = temp -> next;
  }
    printf("NULL \n");
 }
    int main(){
     struct Node * head = NULL

     insert at beginning(&head, 5);
     display(head);

     insert at pos(&head, 15, 3);
     display(head);

     insert at end(&head, 30);
     display(head);

   return 0;
}
```

execute
Namrata M
28/10/2024

output

1. Insert at the beginning
2. Insert at the end
3. Display the list
4. Exit

Enter your choice : 1
Enter value to insert at the beginning : 12

Enter your choice : 2
Enter the value to insert at the end : 23

Enter your choice : 3
linked list : 12 → 23 → NULL

Enter your choice : 1
enter : 98

Enter your choice : 2
enter : 568

Enter your choice 3
~~enter~~ :
linked list : 98 → 12 → 23 → 568 → NULL

o/p seen

Program 5

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.

Code:

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

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

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

void insertatfirst(struct Node** head, int data){
   struct Node* newnode =createNode(data);
   newnode->next = *head;
   *head = newnode;
}

void deleteFirst(struct Node** head) {
   if (*head == NULL) {
      printf("The list is empty.\n");
      return;
   }
   struct Node* temp = *head;
   *head = (*head)->next;
   free(temp);
}

void deleteElement(struct Node** head, int key) {
   if (*head == NULL) {
      printf("The list is empty.\n");
      return;
   }
   struct Node *temp = *head, *prev = NULL;
   if (temp != NULL && temp->data == key) {
```

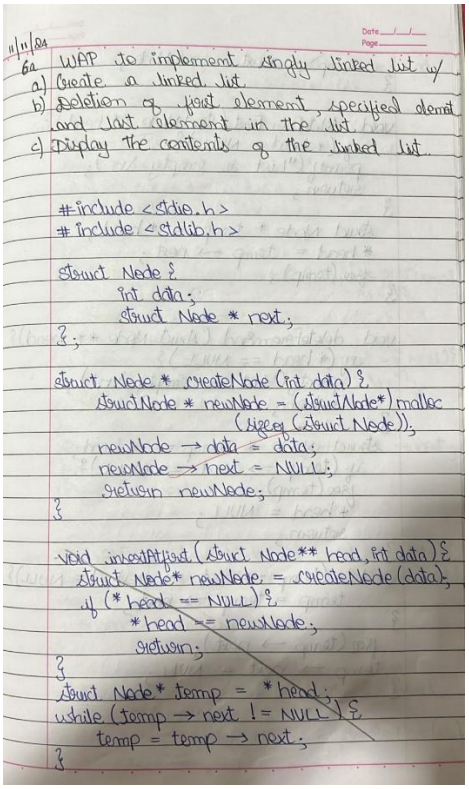
```
        *head = temp->next;
        free(temp);
        return;
    }
    while (temp != NULL && temp->data != key) {
        prev = temp;
        temp = temp->next;
    }
    if (temp == NULL) {
        printf("Element %d not found.\n", key);
        return;
    }
    prev->next = temp->next;
    free(temp);
}

void deleteLast(struct Node** head) {
    if (*head == NULL) {
        printf("The list is empty.\n");
        return;
    }
    struct Node *temp = *head, *prev = NULL;
    if (temp->next == NULL) {
        *head = NULL;
        free(temp);
        return;
    }
    while (temp->next != NULL) {
        prev = temp;
        temp = temp->next;
    }
    prev->next = NULL;
    free(temp);
}

void displayList(struct Node* head) {
    if (head == NULL) {
        printf("The list is empty.\n");
        return;
    }
    struct Node* temp = head;
    while (temp != NULL) {
        printf("%d -> ", temp->data);
        temp = temp->next;
    }
    printf("NULL\n");
}
```

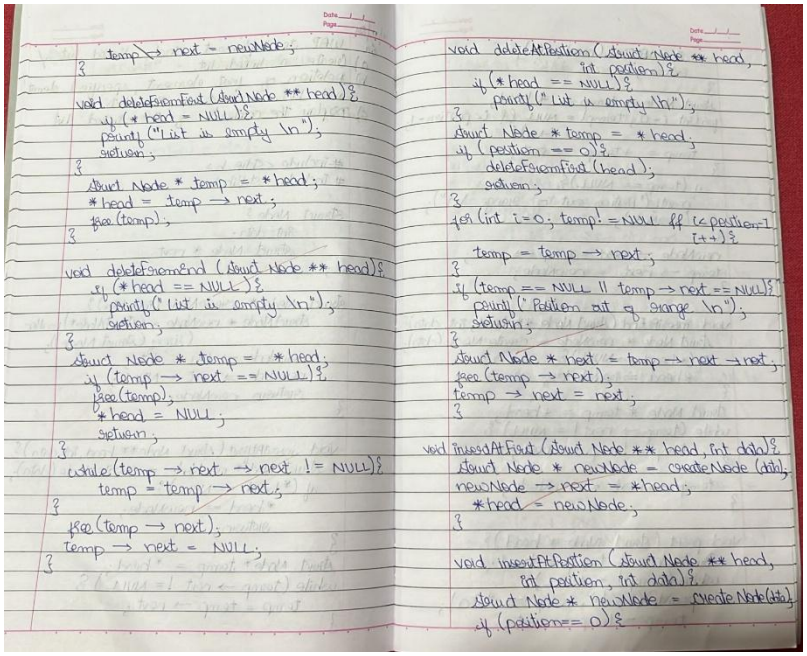
```
int main() {
    struct Node* head = NULL;
    int choice, value;

    while (1) {
        printf("\nMenu:\n");
        printf("1. Insert element at the end\n 2. Delete first element\n 3.Delete specified element\n
4.Delete last element\n 5.Display list\n 6.Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter value to insert: ");
                scanf("%d", &value);
                insertatfirst(&head, value);
                break;
            case 2:
                deleteFirst(&head);
                break;
            case 3:
                printf("Enter value to delete: ");
                scanf("%d", &value);
                deleteElement(&head, value);
                break;
            case 4:
                deleteLast(&head);
                break;
            case 5:
                displayList(head);
                break;
            case 6:
                exit(0);
            default:
                printf("Invalid choice.\n");
        }
    }
    return 0;
}
```

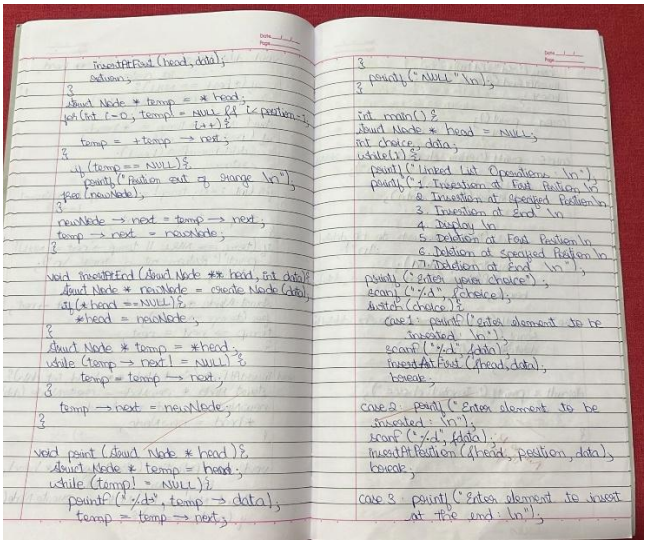
```
Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 2

Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 5
38 -> 23 -> 14 -> NULL

Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 4
```

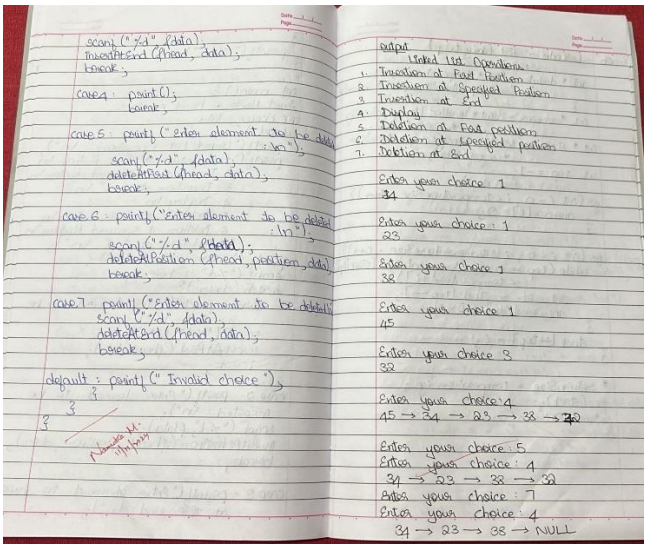
```
Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 1
Enter value to insert: 38

Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 1
Enter value to insert: 45

Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 5
45 -> 38 -> 23 -> 14 -> NULL
```

```
Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 5
38 -> 23 -> NULL

Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 3
Enter value to delete: 23

Menu:
1. Insert element at the end
 2. Delete first element
 3.Delete specified element
 4.Delete last element
 5.Display list
 6.Exit
Enter your choice: 5
38 -> NULL
```









Program 6a

Write A Program to Implement Single Link List with following operations:
Sort the linked list,
Reverse the linked list,
Concatenation of two linked lists.

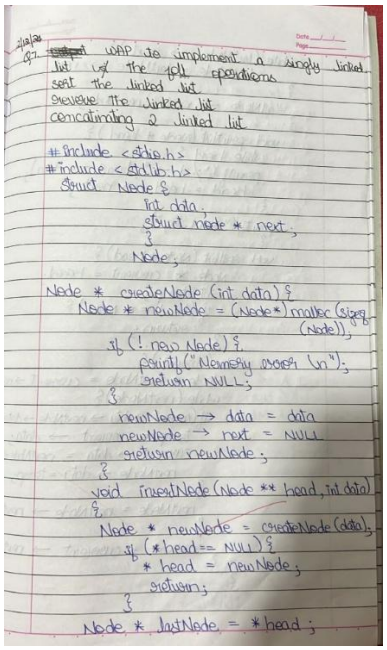
Code:

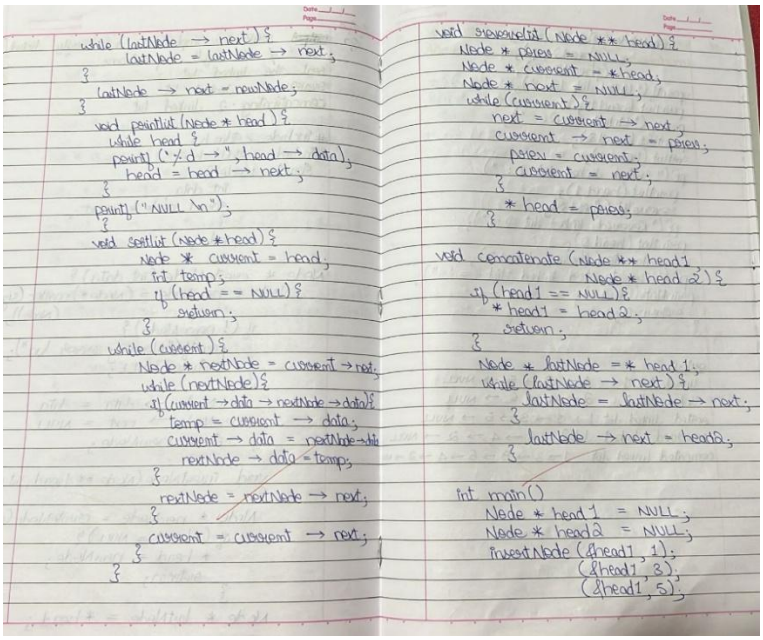
```
#include <stdio.h>
#include <stdlib.h>

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

Node* createNode(int data) {
    Node* newNode = (Node*)malloc(sizeof(Node));
    if (!newNode) {
        printf("Memory error\n");
        return NULL;
    }
    newNode->data = data;
    newNode->next = NULL;
    return newNode;
}

void insertNode(Node** head, int data) {
    Node* newNode = createNode(data);
    if (*head == NULL) {
```

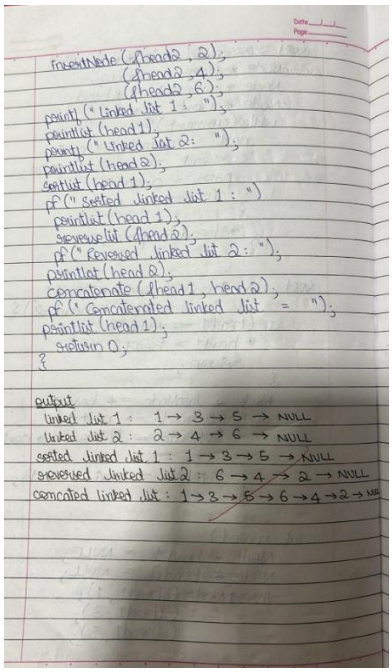
```
        *head = newNode;
        return;
    }
    Node* lastNode = *head;
    while (lastNode->next) {
        lastNode = lastNode->next;
    }
    lastNode->next = newNode;
}

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

void sortlist(Node* head) {
    if (head == NULL) {
        return;
    }
    Node* current;
    Node* nextNode;
    int temp;
    for (current = head; current != NULL; current = current->next) {
        for (nextNode = current->next; nextNode != NULL; nextNode = nextNode->next) {
            if (current->data > nextNode->data) {
                temp = current->data;
                current->data = nextNode->data;
                nextNode->data = temp;
            }
        }
    }
}

void reverselist(Node** head) {
    Node* prev = NULL;
    Node* current = *head;
    Node* next = NULL;
    while (current) {
        next = current->next;
        current->next = prev;
        prev = current;
        current = next;
    }
```

```
    *head = prev;
}

void concatenate(Node** head1, Node* head2) {
    if (*head1 == NULL) {
        *head1 = head2;
        return;
    }
    Node* lastNode = *head1;
    while (lastNode->next) {
        lastNode = lastNode->next;
    }
    lastNode->next = head2;
}

int main() {
    Node* head1 = NULL;
    Node* head2 = NULL;

    insertNode(&head1, 1);
    insertNode(&head1, 3);
    insertNode(&head1, 5);

    insertNode(&head2, 2);
    insertNode(&head2, 4);
    insertNode(&head2, 6);

    printf("Linked list 1: ");
    printlist(head1);

    printf("Linked list 2: ");
    printlist(head2);

    sortlist(head1);
    printf("Sorted Linked list 1: ");
    printlist(head1);

    reverselist(&head2);
    printf("Reversed Linked list 2: ");
    printlist(head2);

    concatenate(&head1, head2);
    printf("Concatenated Linked list: ");
    printlist(head1);

    return 0;
}
```

```
Linked list 1: 1 -> 3 -> 5 -> NULL
Linked list 2: 2 -> 4 -> 6 -> NULL
Sorted Linked list 1: 1 -> 3 -> 5 -> NULL
Reversed Linked list 2: 6 -> 4 -> 2 -> NULL
Concatenated Linked list: 1 -> 3 -> 5 -> 6 -> 4 -> 2 -> NULL
```







Program 6b

Write A Program to Implement Single Link List to simulate Stack & Queue Operations.

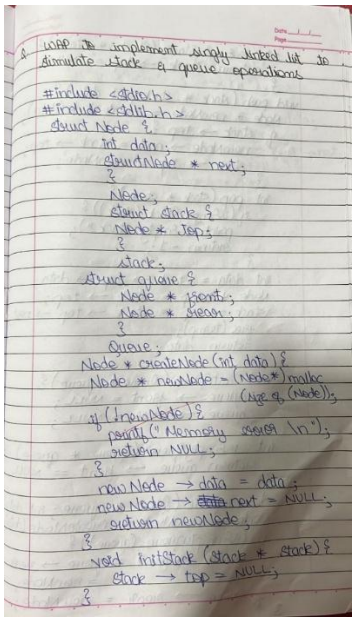
Code:

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

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

Node* createNode(int data) {
   Node* newNode = (Node*)malloc(sizeof(Node));
   if (!newNode) {
      printf("Memory allocation error\n");
      return NULL;
   }
   newNode->data = data;
   newNode->next = NULL;
   return newNode;
}

void push(Node** top, int data) {
   Node* newNode = createNode(data);
   if (!newNode) return;
   newNode->next = *top;
   *top = newNode;
   printf("%d pushed to stack\n", data);
}

int pop(Node** top) {
   if (*top == NULL) {
      printf("Stack Underflow\n");
      return -1;
   }
   Node* temp = *top;
   int poppedData = temp->data;
   *top = temp->next;
   free(temp);
   printf("%d popped from stack\n", poppedData);
   return poppedData;
}

void displayStack(Node* top) {
```

```
    if (top == NULL) {
        printf("Stack is empty\n");
        return;
    }
    printf("Stack: ");
    Node* temp = top;
    while (temp) {
        printf("%d -> ", temp->data);
        temp = temp->next;
    }
    printf("NULL\n");
}

void enqueue(Node** front, Node** rear, int data) {
    Node* newNode = createNode(data);
    if (!newNode) return;
    if (*rear == NULL) {
        *front = *rear = newNode;
    } else {
        (*rear)->next = newNode;
        *rear = newNode;
    }
    printf("%d enqueued to queue\n", data);
}

int dequeue(Node** front, Node** rear) {
    if (*front == NULL) {
        printf("Queue Underflow\n");
        return -1;
    }
    Node* temp = *front;
    int dequeuedData = temp->data;
    *front = temp->next;
    if (*front == NULL) {
        *rear = NULL;
    }
    free(temp);
    printf("%d dequeued from queue\n", dequeuedData);
    return dequeuedData;
}

void displayQueue(Node* front) {
    if (front == NULL) {
        printf("Queue is empty\n");
        return;
    }
    printf("Queue: ");
```

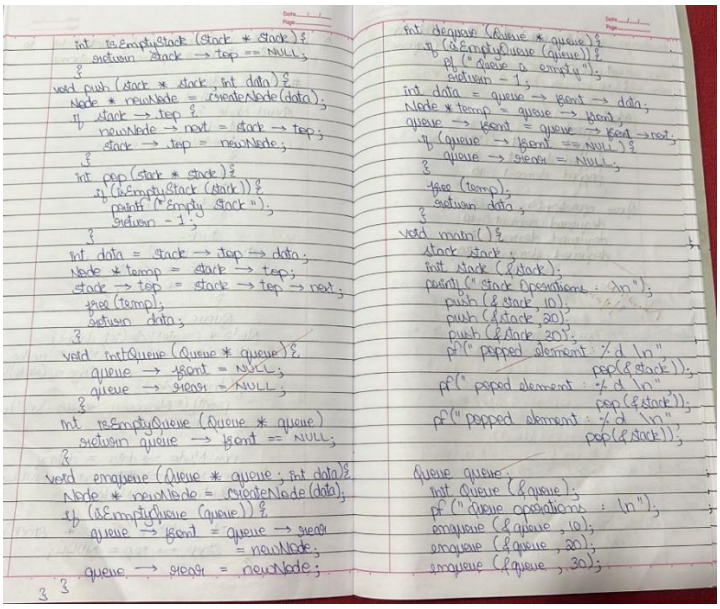
```
    Node* temp = front;
    while (temp) {
        printf("%d -> ", temp->data);
        temp = temp->next;
    }
    printf("NULL\n");
}

int main() {
    Node* stackTop = NULL;

    printf("\n--- Stack Operations ---\n");
    push(&stackTop, 10);
    push(&stackTop, 20);
    push(&stackTop, 30);
    displayStack(stackTop);
    pop(&stackTop);
    displayStack(stackTop);

    Node* queueFront = NULL;
    Node* queueRear = NULL;

    printf("\n--- Queue Operations ---\n");
    enqueue(&queueFront, &queueRear, 1);
    enqueue(&queueFront, &queueRear, 2);
    enqueue(&queueFront, &queueRear, 3);
    displayQueue(queueFront);
    dequeue(&queueFront, &queueRear);
    displayQueue(queueFront);

    return 0;
}
```

```
--- Stack Operations ---
10 pushed to stack
20 pushed to stack
30 pushed to stack
Stack: 30 -> 20 -> 10 -> NULL
30 popped from stack
Stack: 20 -> 10 -> NULL

--- Queue Operations ---
1 enqueued to queue
2 enqueued to queue
3 enqueued to queue
Queue: 1 -> 2 -> 3 -> NULL
1 dequeued from queue
Queue: 2 -> 3 -> NULL
```



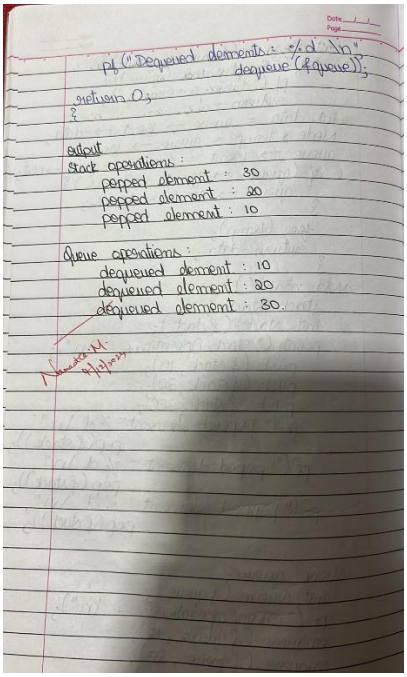
WAP to implement singly linked list to simulate stack & queue operations

```
#include <stdio.h>
#include <stdlib.h>
struct Node {
    int data;
    struct Node * next;
};
Node;
struct stack {
    Node * top;
};
stack;
struct queue {
    Node * front;
    Node * rear;
};
Queue;
Node * createNode (int data) {
    Node * newNode = (Node*) malloc
                     (sizeof (Node));
    if (!newNode) {
        printf ("Memory error \n");
        return NULL;
    }
    newNode -> data = data;
    newNode -> data next = NULL;
    return newNode;
}
void initStack (stack * stack) {
    stack -> top = NULL;
}
```



```
int isEmptyStack (stack * stack) {
    return stack -> top == NULL;
}
void push (stack * stack, int data) {
    Node * newNode = createNode (data);
    if stack -> top {
        newNode -> next = stack -> top;
        stack -> top = newNode;
    }
int pop (stack * stack) {
    if (isEmptyStack (stack)) {
        printf ("Empty stack");
        return -1;
    }
int data = stack -> top -> data;
Node * temp = stack -> top;
stack -> top = stack -> top -> next;
free (temp);
return data;
}
void initQueue (Queue * queue) {
    queue -> front = NULL;
    queue -> rear = NULL;
}
int isEmptyQueue (Queue * queue)
    return queue -> front == NULL;
}
void enqueue (Queue * queue, int data) {
    Node * newNode = createNode (data);
    if (isEmptyQueue (queue)) {
        queue -> front = queue -> rear
                       = newNode;
    queue -> rear = newNode;
}
```

```
int dequeue (Queue * queue) {
    if (isEmptyQueue (queue)) {
        pf ("Queue is empty");
        return -1;
    }
int data = queue -> front -> data;
Node * temp = queue -> front;
queue -> front = queue -> front -> next;
if (queue -> front == NULL) {
    queue -> rear = NULL;
}
free (temp);
return data;
}
void main() {
    stack stack;
    int stack (&stack);
    printf ("Stack Operations : \n");
        push (&stack, 10);
        push (&stack, 20);
        push (&stack, 30);
        pf ("popped element : %d \n"
                pop(&stack));
    pf ("popped element : %d \n"
                pop(&stack));
    pf ("popped element : %d \n"
                pop(&stack));

    Queue queue;
    init Queue (&queue);
    pf ("Queue operations : \n");
    enqueue (&queue, 10);
    enqueue (&queue, 20);
    enqueue (&queue, 30);
```



```
    pf ("Dequeued elements : %d \n"
                dequeue (&queue));
    return 0;
}
```

output

Stack operations :
popped element : 30
popped element : 20
popped element : 10

Queue operations :
dequeued element : 10
dequeued element : 20
dequeued element : 30.

Program 7

Write A Program to Implement doubly link list with primitive operations
a) Create a doubly linked list.
b) Insert a new node to the left of the node.
c) Delete the node based on a specific value
d) Display the contents of the list

Code:

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

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

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

void insertAtBeginning(struct Node** head, int data) {
   struct Node* newNode = createNode(data);
   if (*head == NULL) {
      *head = newNode;
   } else {
      newNode->next = *head;
      (*head)->prev = newNode;
      *head = newNode;
   }
}

void insertAtPosition(struct Node** head, int data, int position) {
   if (position < 1) {
      printf("Invalid position!\n");
      return;
   }

   struct Node* newNode = createNode(data);
   if (position == 1) {
      insertAtBeginning(head, data);
```

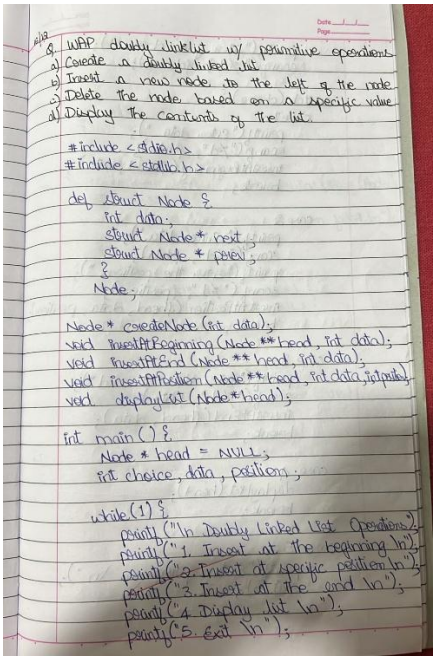
```
        return;
    }

    struct Node* temp = *head;
    for (int i = 1; temp != NULL && i < position - 1; i++) {
        temp = temp->next;
    }

    if (temp == NULL) {
        printf("Position out of bounds!\n");
        free(newNode);
        return;
    }

    newNode->next = temp->next;
    newNode->prev = temp;
    if (temp->next != NULL) {
        temp->next->prev = newNode;
    }
    temp->next = newNode;
}

void insertAtEnd(struct Node** head, int data) {
    struct Node* newNode = createNode(data);
    if (*head == NULL) {
        *head = newNode;
        return;
    }

    struct Node* temp = *head;
    while (temp->next != NULL) {
        temp = temp->next;
    }
    temp->next = newNode;
    newNode->prev = temp;
}

void displayList(struct Node* head) {
    if (head == NULL) {
        printf("List is empty!\n");
        return;
    }

    struct Node* temp = head;
    printf("List contents: ");
    while (temp != NULL) {
        printf("%d ", temp->data);
```

```
        temp = temp->next;
    }
    printf("\n");
}

int main() {
    struct Node* head = NULL;
    int choice, data, position;

    while (1) {
        printf("\nDoubly Linked List Operations:\n");
        printf("1. Insert at Beginning\n");
        printf("2. Insert at Position\n");
        printf("3. Insert at End\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 beginning: ");
                scanf("%d", &data);
                insertAtBeginning(&head, data);
                break;
            case 2:
                printf("Enter data to insert: ");
                scanf("%d", &data);
                printf("Enter position: ");
                scanf("%d", &position);
                insertAtPosition(&head, data, position);
                break;
            case 3:
                printf("Enter data to insert at end: ");
                scanf("%d", &data);
                insertAtEnd(&head, data);
                break;
            case 4:
                displayList(head);
                break;
            case 5:
                printf("Exiting program.\n");
                exit(0);
            default:
                printf("Invalid choice! Please try again.\n");
        }
    }
```

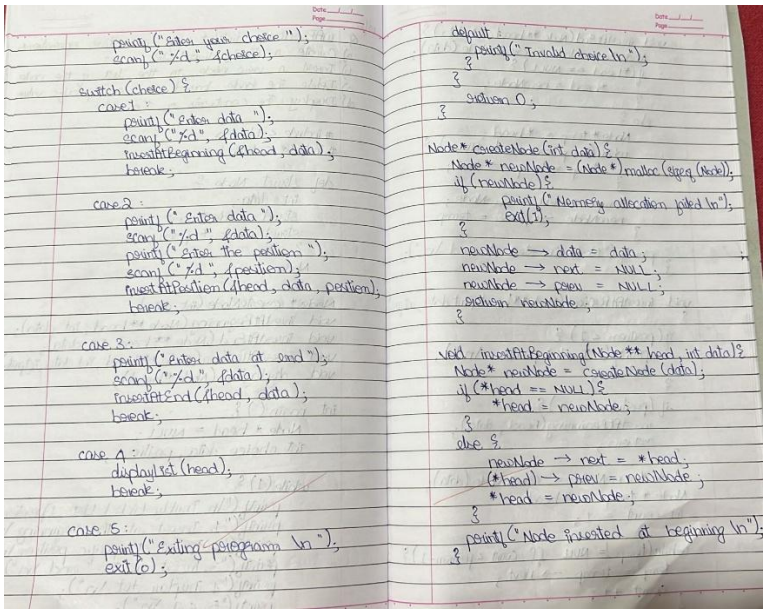
```
    return 0;
}
```

```
Doubly Linked List Operations:
1. Insert at Beginning
2. Insert at Position
3. Insert at End
4. Display List
5. Exit
Enter your choice: 1
Enter data to insert at beginning: 1

Doubly Linked List Operations:
1. Insert at Beginning
2. Insert at Position
3. Insert at End
4. Display List
5. Exit
Enter your choice: 2
Enter data to insert: 2
Enter position: 2

Doubly Linked List Operations:
1. Insert at Beginning
2. Insert at Position
3. Insert at End
4. Display List
5. Exit
Enter your choice: 3
Enter data to insert at end: 3
```

```
Doubly Linked List Operations:
1. Insert at Beginning
2. Insert at Position
3. Insert at End
4. Display List
5. Exit
Enter your choice: 4
List contents: 1 2 3

Doubly Linked List Operations:
1. Insert at Beginning
2. Insert at Position
3. Insert at End
4. Display List
5. Exit
Enter your choice: 5
Exiting program.
```

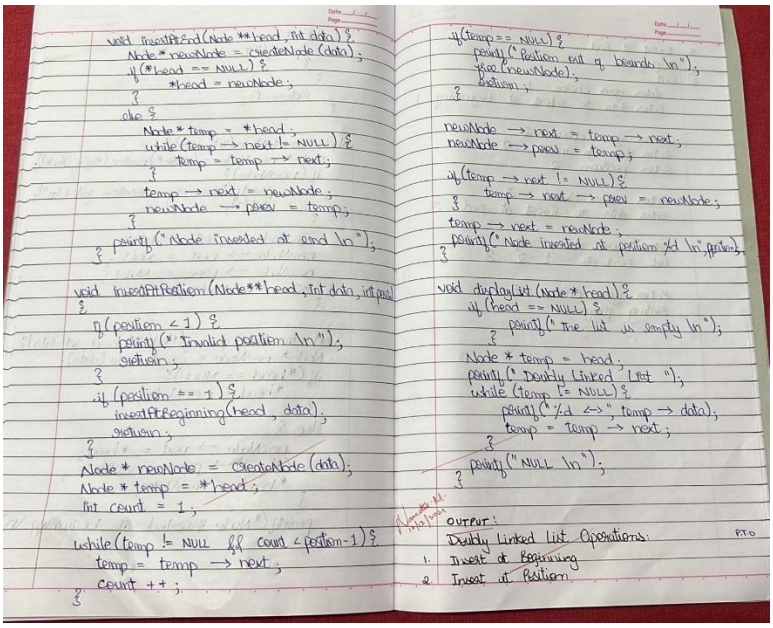


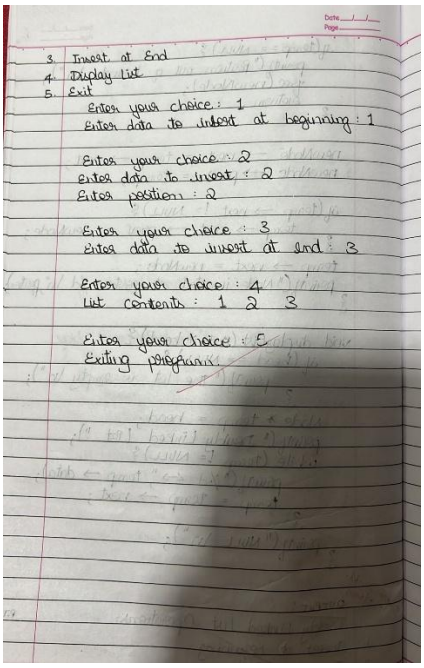
```
WAP doubly linklist w/ primitive operations
a) Create a doubly linked list
b) Insert a new node to the left of the node
c) Delete the node based on a specific value
d) Display the contents of the list.

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

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

Node* createNode(int data);
void insertAtBeginning(Node **head, int data);
void insertAtEnd(Node **head, int data);
void insertAtPosition(Node **head, int data, int pos);
void displayList(Node*head);

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

    while(1) {
        printf("\n Doubly Linked List Operations:");
        printf("\n 1. Insert at the beginning \n");
        printf("\n 2. Insert at specific position \n");
        printf("\n 3. Insert at the end \n");
        printf("\n 4. Display list \n");
        printf("\n 5. Exit \n");
```



```
        printf("\n Enter your choice ");
        scanf("%d", &choice);

    switch (choice) {
    case1:
        printf("\n Enter data ");
        scanf("%d", &data);
        insertAtBeginning(&head, data);
        break;

    case 2:
        printf("\n Enter data ");
        scanf("%d", &data);
        printf("\n Enter the position ");
        scanf("%d", &position);
        insertAtPosition(&head, data, position);
        break;

    case 3:
        printf("\n Enter data at end");
        scanf("%d", &data);
        insertAtEnd(&head, data);
        break;

    case 4:
        displayList(head);
        break;

    case 5:
        printf("\n Exiting programm \n");
        exit(0);
```

```
    default:
        printf("\n Invalid choice \n");
    }
    return 0;
}

Node* createNode(int data) {
    Node* newNode = (Node*)malloc(sizeof(Node));
    if(newNode) {
        printf("\n Memory allocation failed \n");
        exit(1);
    }
    newNode -> data = data;
    newNode -> next = NULL;
    newNode -> prev = NULL;
    return newNode;
}

void insertAtBeginning(Node** head, int data) {
    Node* newNode = createNode(data);
    if(*head == NULL) {
        *head = newNode;
    }
    else {
        newNode -> next = *head;
        (*head) -> prev = newNode;
        *head = newNode;
    }
    printf("\n Node inserted at beginning \n");
}
```





Program 8

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

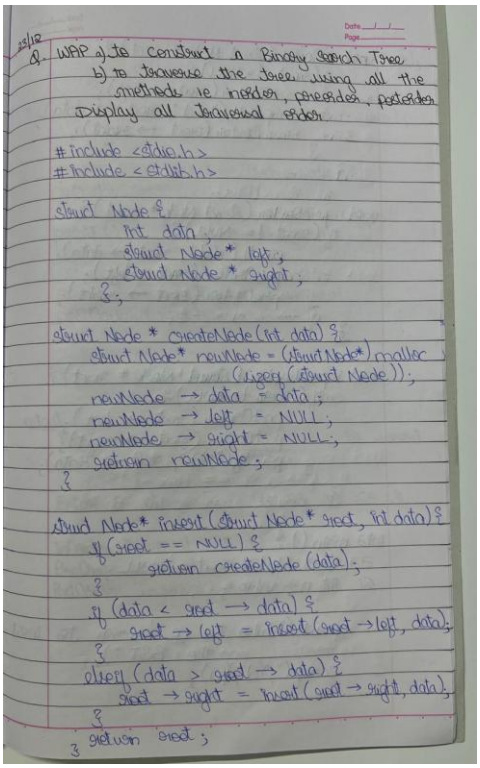
Code:

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

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

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

struct Node* insert(struct Node* root, int data) {
    if (root == NULL) {
```

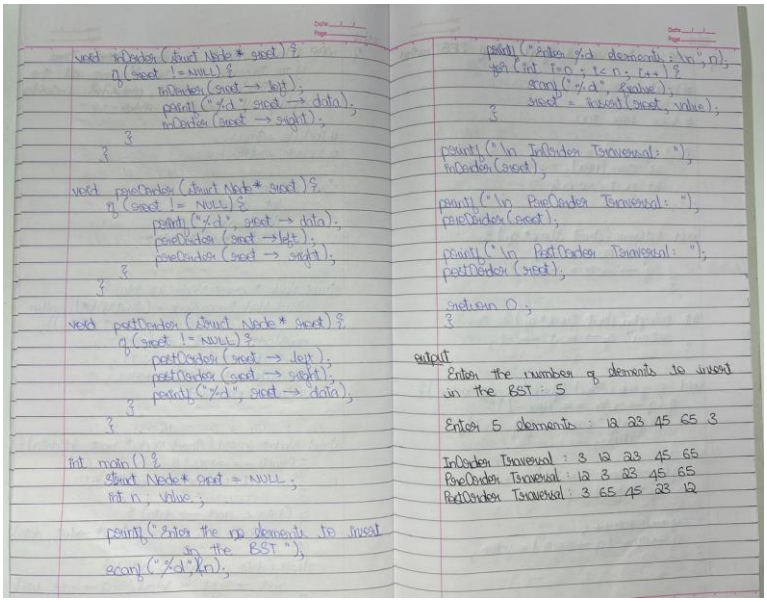
```
        return createNode(data);
    }
    if (data < root->data) {
        root->left = insert(root->left, data);
    } else if (data > root->data) {
        root->right = insert(root->right, data);
    }
    return root;
}

void inOrder(struct Node* root) {
    if (root != NULL) {
        inOrder(root->left);
        printf("%d ", root->data);
        inOrder(root->right);
    }
}

void preOrder(struct Node* root) {
    if (root != NULL) {
        printf("%d ", root->data);
        preOrder(root->left);
        preOrder(root->right);
    }
}

void postOrder(struct Node* root) {
    if (root != NULL) {
        postOrder(root->left);
        postOrder(root->right);
        printf("%d ", root->data);
    }
}

int main() {
    struct Node* root = NULL;
    int n, value;

    printf("Enter the number of elements to insert in the BST: ");
    scanf("%d", &n);

    printf("Enter %d elements:\n", n);
    for (int i = 0; i < n; i++) {
        scanf("%d", &value);
        root = insert(root, value);
    }
```

```
    printf("\nIn-order Traversal: ");
    inOrder(root);

    printf("\nPre-order Traversal: ");
    preOrder(root);

    printf("\nPost-order Traversal: ");
    postOrder(root);

    return 0;
}
```

```
Enter the number of elements to insert in the BST: 5
Enter 5 elements:
12 23 45 65 3

In-order Traversal: 3 12 23 45 65
Pre-order Traversal: 12 3 23 45 65
Post-order Traversal: 3 65 45 23 12
```



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

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

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

struct Node* insert(struct Node* root, int data) {
    if (root == NULL) {
        return createNode(data);
    }
    if (data < root->data) {
        root->left = insert(root->left, data);
    } else if (data > root->data) {
        root->right = insert(root->right, data);
    }
    return root;
}
```



```
void inOrder(struct Node* root) {
    if (root != NULL) {
        inOrder(root->left);
        printf("%d ", root->data);
        inOrder(root->right);
    }
}

void preOrder(struct Node* root) {
    if (root != NULL) {
        printf("%d ", root->data);
        preOrder(root->left);
        preOrder(root->right);
    }
}

void postOrder(struct Node* root) {
    if (root != NULL) {
        postOrder(root->left);
        postOrder(root->right);
        printf("%d ", root->data);
    }
}

int main() {
    struct Node* root = NULL;
    int n, value;

    printf("Enter the no.of elements to insert in the BST: ");
    scanf("%d", &n);

    printf("Enter %d elements: \n", n);
    for (int i = 0; i < n; i++) {
        scanf("%d", &value);
        root = insert(root, value);
    }

    printf("\n In InOrder Traversal: ");
    inOrder(root);

    printf("\n In PreOrder Traversal: ");
    preOrder(root);

    printf("\n In PostOrder Traversal: ");
    postOrder(root);

    return 0;
}
```

output

```
Enter the number of elements to insert in the BST: 5

Enter 5 elements: 12 23 45 65 3

InOrder Traversal : 3 12 23 45 65
PreOrder Traversal : 12 3 23 45 65
PostOrder Traversal : 3 65 45 23 12
```

Program 9a

Write a program to traverse a graph using BFS method.

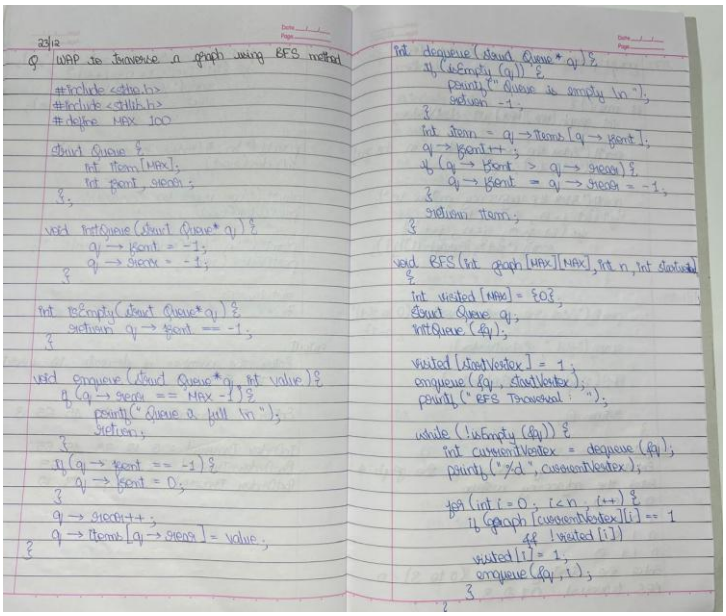
Code:

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

#define MAX 100

struct Queue {
   int items[MAX];
   int front, rear;
};

void initQueue(struct Queue* q) {
   q->front = -1;
   q->rear = -1;
}

int isEmpty(struct Queue* q) {
   return q->front == -1;
}

void enqueue(struct Queue* q, int value) {
   if (q->rear == MAX - 1) {
      printf("Queue is full\n");
      return;
   }

   if (q->front == -1) {
      q->front = 0;
   }
   q->rear++;
   q->items[q->rear] = value;
}

int dequeue(struct Queue* q) {
   if (isEmpty(q)) {
      printf("Queue is empty\n");
      return -1;
   }
   int item = q->items[q->front];
   q->front++;
   if (q->front > q->rear) {
      q->front = q->rear = -1;
```

```
    }
    return item;
}

void BFS(int graph[MAX][MAX], int n, int startVertex) {
    int visited[MAX] = {0};
    struct Queue q;
    initQueue(&q);

    visited[startVertex] = 1;
    enqueue(&q, startVertex);

    printf("BFS Traversal: ");

    while (!isEmpty(&q)) {
        int currentVertex = dequeue(&q);
        printf("%d ", currentVertex);

        for (int i = 0; i < n; i++) {
            if (graph[currentVertex][i] == 1 && !visited[i]) {
                visited[i] = 1;
                enqueue(&q, i);
            }
        }
    }
    printf("\n");
}

int main() {
    int graph[MAX][MAX], n, startVertex;

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

    printf("Enter the adjacency matrix of the graph:\n");
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            scanf("%d", &graph[i][j]);
        }
    }

    printf("Enter the starting vertex (0 to %d): ", n - 1);
    scanf("%d", &startVertex);

    BFS(graph, n, startVertex);

    return 0;
```

}

```
Enter the number of vertices in the graph: 4
Enter the adjacency matrix of the graph:
0 1 0 0
1 0 1 1
0 1 0 1
0 1 1 0
Enter the starting vertex (0 to 3): 0
BFS Traversal: 0 1 2 3
```



```
#include <stdio.h>
#include <stdlib.h>
#define MAX 100

struct Queue {
    int items[MAX];
    int front, rear;
};

void initQueue(struct Queue* q) {
    q->front = -1;
    q->rear = -1;
}

int isEmpty(struct Queue* q) {
    return q->front == -1;
}

void enqueue(struct Queue* q, int value) {
    if (q->rear == MAX - 1) {
        printf("Queue is full\n");
        return;
    }
    if (q->front == -1)
        q->front = 0;
    q->rear++;
    q->items[q->rear] = value;
}

int dequeue(struct Queue* q) {
    if (isEmpty(q)) {
        printf("Queue is empty\n");
        return -1;
    }
    int item = q->items[q->front];
    q->front++;
    if (q->front > q->rear) {
        q->front = q->rear = -1;
    }
    return item;
}

void BFS(int graph[MAX][MAX], int n, int startVertex) {
    int visited[MAX] = {0};
    struct Queue q;
    initQueue(&q);

    visited[startVertex] = 1;
    enqueue(&q, startVertex);
    printf("BFS Traversal: ");

    while (!isEmpty(&q)) {
        int currentVertex = dequeue(&q);
        printf("%d ", currentVertex);

        for (int i = 0; i < n; i++) {
            if (graph[currentVertex][i] == 1 && !visited[i]) {
                visited[i] = 1;
                enqueue(&q, i);
            }
        }
    }
    printf("\n");
}

int main() {
    int graph[MAX][MAX], n, startVertex;

    printf("Enter the no of vertices in the graph: ");
    scanf("%d", &n);

    printf("Enter the adjacency matrix\n");
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            scanf("%d", &graph[i][j]);
        }
    }

    printf("Enter the starting vertex (0 to %d): ", n-1);
    scanf("%d", &startVertex);

    BFS(graph, n, startVertex);

    return 0;
}
```

output

```
Enter the no of vertices in the graph: 4
Enter the adjacency matrix
0 1 0 0
1 0 1 1
0 1 0 1
0 1 1 0
Enter the starting vertex (0 to 3): 0
BFS traversal: 0 1 2 3
```

Program 9b

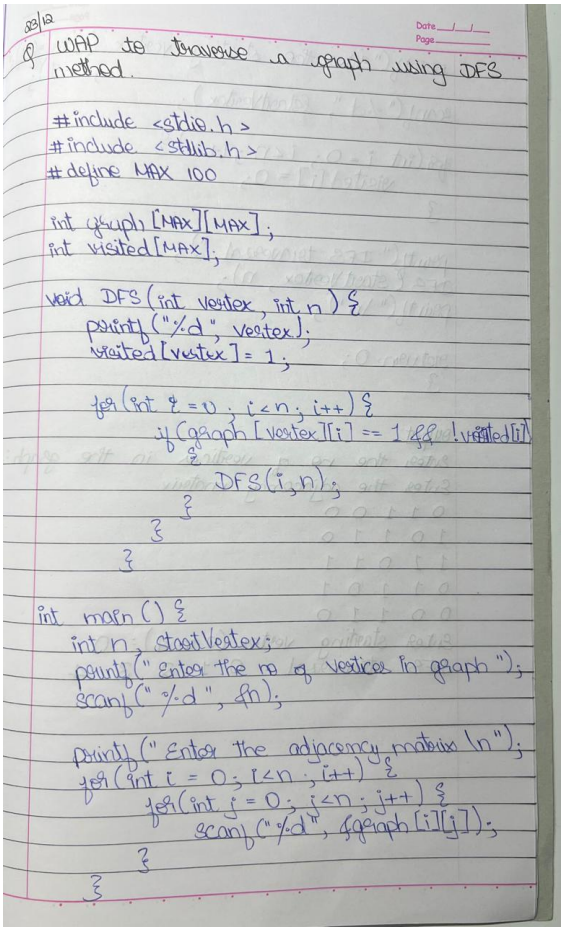
Write a program to traverse through a graph using DFS method.

Code:

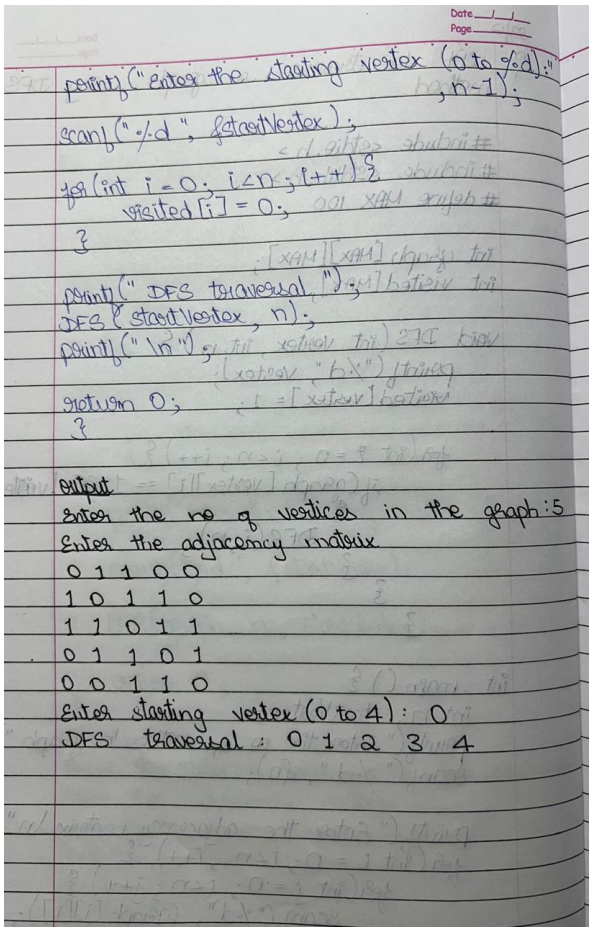
```
#include <stdio.h>
#include <stdlib.h>

#define MAX 100

int graph[MAX][MAX];
int visited[MAX];

void DFS(int vertex, int n) {
   printf("%d ", vertex);
   visited[vertex] = 1;

   for (int i = 0; i < n; i++) {
      if (graph[vertex][i] == 1 && !visited[i]) {
         DFS(i, n);
      }
   }
}

int main() {
   int n, startVertex;

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

   printf("Enter the adjacency matrix of the graph:\n");
   for (int i = 0; i < n; i++) {
      for (int j = 0; j < n; j++) {
         scanf("%d", &graph[i][j]);
      }
   }

   printf("Enter the starting vertex (0 to %d): ", n - 1);
   scanf("%d", &startVertex);

   for (int i = 0; i < n; i++) {
      visited[i] = 0;
   }

   printf("DFS Traversal: ");
   DFS(startVertex, n);
```

```
    printf("\n");

    return 0;
}
```

```
Enter the number of vertices in the graph: 5
Enter the adjacency matrix of the graph:
0 1 1 0 0
1 0 1 1 0
1 1 0 1 1
0 1 1 0 1
0 0 1 1 0
Enter the starting vertex (0 to 4): 0
DFS Traversal: 0 1 2 3 4
```



```
WAP to traverse a graph using DFS method.

#include <stdio.h>
#include <stdlib.h>
#define MAX 100

int graph[MAX][MAX];
int visited[MAX];

void DFS(int vertex, int n){
    printf("%d", vertex);
    visited[vertex] = 1;

    for(int i=0; i<n; i++){
        if(graph[vertex][i] == 1 && !visited[i]){
            DFS(i,n);
        }
    }
}

int main(){
    int n, startVertex;
    printf("Enter the no of vertices in graph");
    scanf("%d", &n);

    printf("Enter the adjacency matrix\n");
    for(int i=0; i<n; i++){
        for(int j=0; j<n; j++){
            scanf("%d", &graph[i][j]);
        }
    }
```



```
    printf("Enter the starting vertex (0 to %d):", n-1);
    scanf("%d", &startVertex);

    for(int i=0; i<n; i++){
        visited[i] = 0;
    }

    printf("DFS traversal");
    DFS(startVertex, n);
    printf("\n");

    return 0;
}
```

Output

```
Enter the no of vertices in the graph: 5
Enter the adjacency matrix
0 1 1 0 0
1 0 1 1 0
1 1 0 1 1
0 1 1 0 1
0 0 1 1 0
Enter starting vertex (0 to 4): 0
DFS traversal: 0 1 2 3 4
```