VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT

on

DATA STRUCTURES IN C

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

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**OBJECT ORIENTED JAVA PROGRAMMING**" carried out by **SRUJAN K R(1BM23CS340),** who is bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2024-25. The Lab report has been approved as it satisfies the academic requirements in respect of **Object-Oriented Java Programming Lab - (23CS3PCOOJ)** work prescribed for the said degree.

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https://github.com/Srujan4812/1BM23CS340-DS-C

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

Observation:

```
(1) #include stdio.h

Struct Stack {
    int top;
    int items [max];
};

Void intstack (Strucct Stack *s) {
    S->top = -1;
}

int is-full (Strucct stack *s) {
    return s->top == max-1;
}

int isEmpty (struct stack *s) {
    return s->top == -1;
}

Void push (Struct stack *s, int item) {
    if (! isfull (s)) {
    S->items [++s -> top] = item;
    Printf (" pushed %d onto stack \n");
    }
    else {
        Print (" stack overflow );
    }
}
```

```
int
void pop (Struct Stack * s) {
    if (!isempty(s)) {
        return s->items [s->top --];
    } else {
        printf ("Stack underflow);
        return -1;
    }
}

int main () {
 Struct Stack * s = (Struct Stack*) malloc (
                       size of (Struct Stack));

push(2s, 10);
push( 2s, 20);
pop (2s, 30);
pop(2s, 30);
peek(2s);

}
```

Output :

Stack size = 3

Step		
1)	40 30 20 10	push(10)
2)		push(20)
3)		push(30)
4)		push(40)

"Stack overflow"

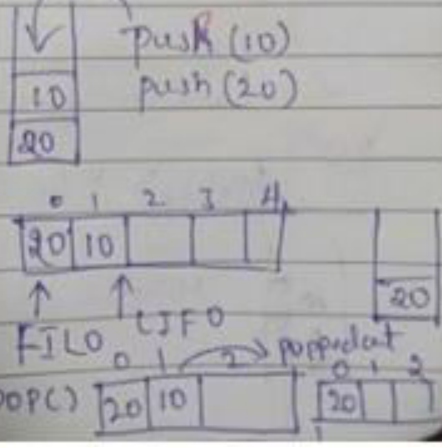
Step	
1)	pop()
2)	pop()
3)	pop()
4)	pop()

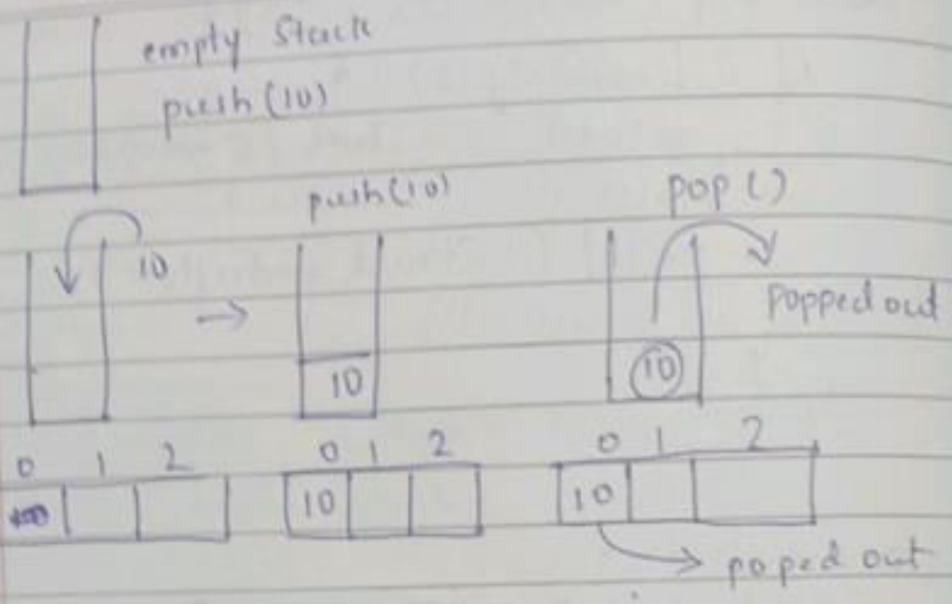
" Stack underflow "

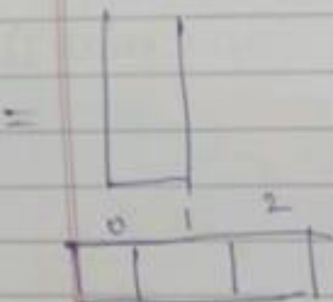
Peek (sp) :

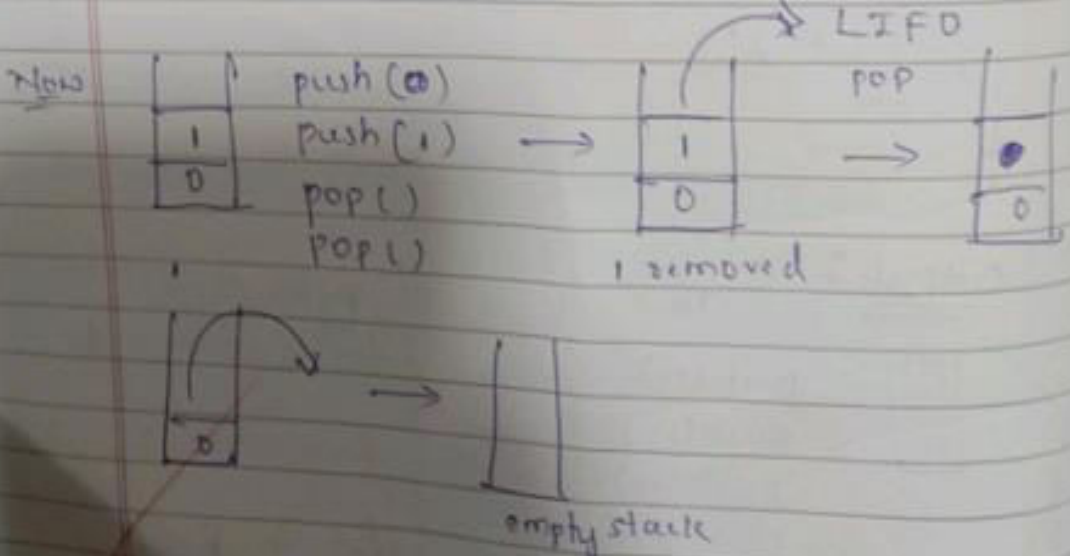
top of stack = 10

free Stack();









LIFO Last in first out

Code:

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

typedef struct {
    int arr[MAX];
    int top;
} Stack;

void push(Stack *s, int value) {
    if (s->top == MAX - 1) {
        printf("Stack Overflow\n");
        return;
    }
    s->arr[++(s->top)] = value;
    printf("Pushed %d\n", value);
}

void pop(Stack *s) {
    if (s->top == -1) {
        printf("Stack Underflow\n");
        return;
    }
    printf("Popped %d\n", s->arr[(s->top)--]);
}

void display(Stack *s) {
    if (s->top == -1) {
        printf("Stack is Empty\n");
```

```
        return;
    }
    printf("Stack elements: ");
    for (int i = 0; i <= s->top; i++)
        printf("%d ", s->arr[i]);
    printf("\n");
}

int main() {
    Stack s;
    s.top = -1;
    int choice, value;

    while (1) {
        printf("\nChoose an option:\n");
        printf("1. Push\n2. Pop\n3. Display\n4. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter value to push: ");
                scanf("%d", &value);
                push(&s, value);
                break;
            case 2:
                pop(&s);
                break;
            case 3:
```

```
            display(&s);
            break;
        case 4:
            return 0;
        default:
            printf("Invalid choice!\n");
      }
   }
}
```

Output:

```
srujan  R@SRUJAN MINGW64 ~
$ Choose an option:
1. Push
2. Pop
$ Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 1
Enter value to push: 10
Pushed 10

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 1
Enter value to push: 20
Pushed 20

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 3
Stack elements: 10 20

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 2
Popped 20

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 3
Stack elements: 10

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 4
```

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

Observation:

(2) Prefix to postfix

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

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

 return -1; }

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

void ItP ( 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 [result Index + 1]= c ;
} else if (c== '(') {
      stack [++ stack Index]= c ;
   }
   else if (c=='')')
   {
 While (stackIndex >=0 && stack [stackIndex]
                                  != '(')
 {
result [result Index ++ ] = stack [stack Index--];
 }
 stack Index -- ; } else {
While(stackIndex>=0 && (prec(c) < prec(stack[
   stackIndex])) || (prec(c) == prec (stack [stackIndex]
   == '('))) {
     result [result Index++] = stack[stackIndex--]
  }
 stack [++stack Index]= c ;
 }
 }
 While (stackIndex >=0 ) {
 result [resultIndex++ ] = stack [stackIndex--];
 }
result [result Index ]= '\0' ;
printf (" %s \n", result);
free (result);
free (stack) ; }
```

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

output

I/p a+b*((^d-e)^(f+g*h)-i

output I/p (A+B)*(C-D)

postfix exp: (AB+)*(CD-)

expected o/p AB+CD-*

10/10

my o/p
from execution :

(A+B)*(C-D)

AB+CD-*

8/10

Code:

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

#define MAX 100

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

void push(char c) {
   stack[++top] = c;
}

char pop() {
   return stack[top--];
}

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

void infixToPostfix(char* infix, char* postfix) {
   int i = 0, j = 0;
   char c, temp;

   while ((c = infix[i++]) != '\0') {
```

```
        if (isalnum(c)) {
            postfix[j++] = c;  // Append operand
        } else if (c == '(') {
            push(c);
        } else if (c == ')') {
            while (top != -1 && (temp = pop()) != '(') {
                postfix[j++] = temp;  // Pop till '('
            }
        } else {  // Operator
            while (top != -1 && precedence(stack[top]) >= precedence(c)) {
                postfix[j++] = pop();
            }
            push(c);
        }
    }

    while (top != -1) {
        postfix[j++] = pop();
    }
    postfix[j] = '\0';
}

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

    printf("Enter a valid parenthesized infix expression: ");
    scanf("%s", infix);

    infixToPostfix(infix, postfix);
```

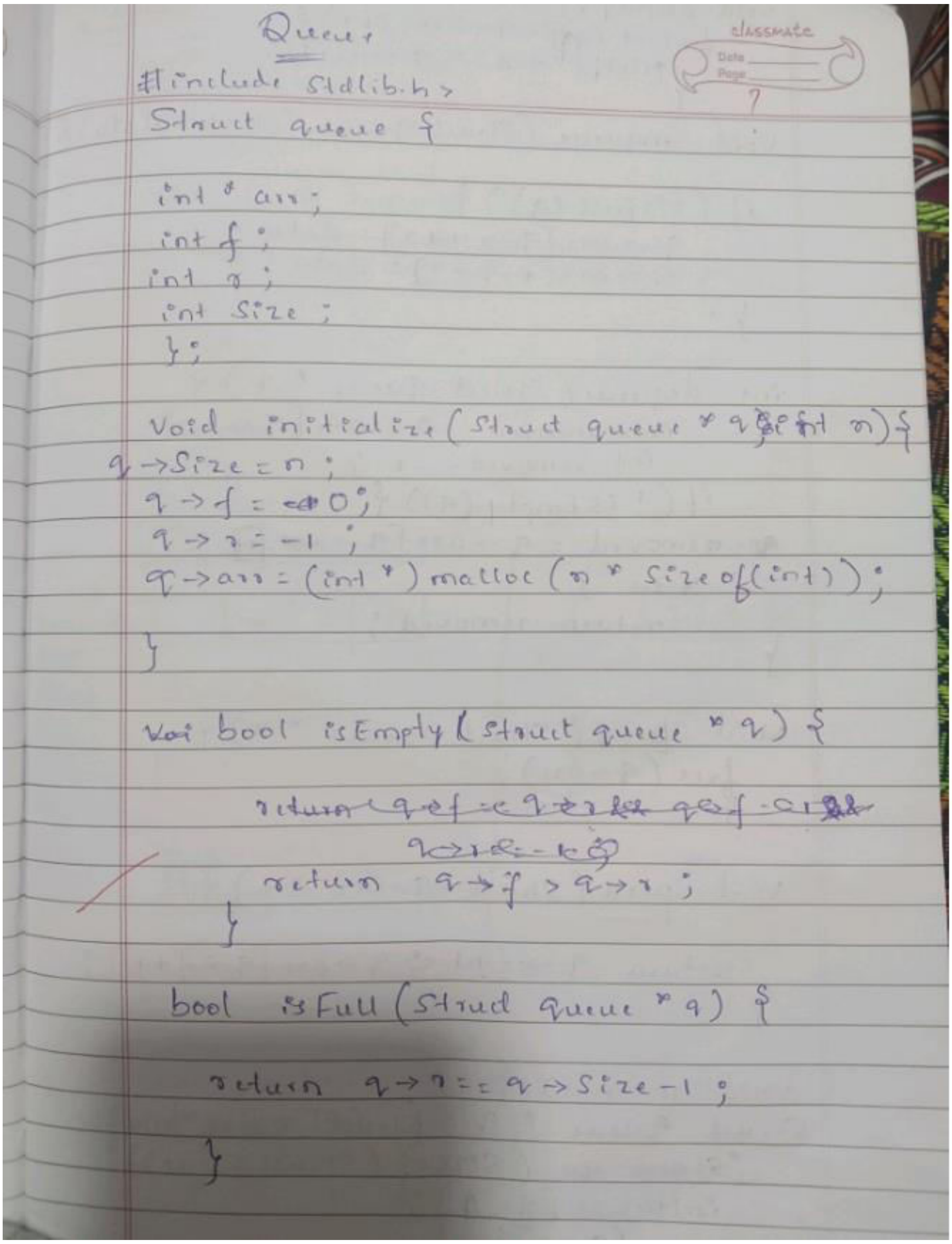
```
    printf("Postfix Expression: %s\n", postfix);


    return 0;
}
```

Output:

```
Enter a valid parenthesized infix expression: (A+B)*(c-D)
Postfix expression: AB+cD-*
```

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

Observation:



```
Queue
#include stdlib.h>
Struct queue {

int * arr;
int f;
int r;
int size;
};

Void initialize(Struct queue * q, int n){
q->Size = n;
q->f = 0;
q->r = -1;
q->arr = (int *) malloc(n * Sizeof(int));

}

bool isEmpty(Struct queue * q) {

return q->f > q->r;
}

bool isFull(Struct Queue * q) {

return q->r == q->Size - 1;

}
```

```
void displayq(...
  for(int i=0; i< q->size; i++){
    printf("%d ", q->arr[i]);
  }

void enqueue (struct queue *q, int data)

  if (!isFull(q)) {
    ~~q->arr[q->r++] = data;~~
    q->arr[++q->r] = data;
  }
}

int dequeue(struct queue * q) {
    ~~int removed = q->arr[q->f~~
    int removed = -1 ;
  if(! isEmpty(q)) {
  removed = q->arr [q-> f++] ;
  }
    return removed;
}

void freeq( struct queue * q) {
  free (q->arr);
  }

void peek( struct queue * q) {

  return q->arr [q->f+1];
}

void main () {
struct queue * q = (struct queue *)malloc
  (sizeof(struct queue));
  initalize (q, 4);
enqueue (q, 10);
dequeue(q);
dequeue (q);
enqueue (q5);
enqueue (q, 6);
} displayq(q);
```

O/P

Size = 4

enqued 4 elements 1 2 3 4

1	2	3	4

added from rear

enqueue again
enqueue(5);
Queue overflow

dequeue();

1	2	3	4

removed from front

	2	3	4

dequeue();

		3	4

dequeue();

			4

dequeue();

FIFO

0	1	2
4	2	

4

0	1	2
	2	4

O/P
5

5 10

Queue underflow
enqueue(1); enqueue(2); enqueue(3);
display(q);

1 2 3 4

Peek(q);
1

Executed
14/10

Output

1) Enqueue
2) Dequeue
3) Display Queue
4) Exit

1)
2 4 5 6

2) 2 4 5 6

3) Dequeued 2

4) == Code execution Successful ==

3) Dequeued 4

3) Dequeued 5

3) Dequeued 6

3) Queue underflow

4) == Code execution successful ==

Code:

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

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

void insert(int val) {
    if (rear == MAX - 1) {
        printf("Queue Overflow\n");
    } else {
        if (front == -1) front = 0;
        queue[++rear] = val;
        printf("Inserted %d\n", val);
    }
}

void delete() {
    if (front == -1 || front > rear) {
        printf("Queue Underflow\n");
    } else {
        printf("Deleted %d\n", queue[front++]);
        if (front > rear) front = rear = -1;
    }
}

void display() {
    if (front == -1) {
        printf("Queue is Empty\n");
```

```
    } else {
        printf("Queue elements: ");
        for (int i = front; i <= rear; i++) printf("%d ", queue[i]);
        printf("\n");
    }
}

int main() {
    int choice, value;
    while (1) {
        printf("\nLinear Queue Operations:\n1. Insert\n2. Delete\n3. Display\n4. Exit\nEnter
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:
                return 0;
            default:
                printf("Invalid choice!\n");
        }
```

```
    }
}
```

Output:

```
srujan  R@SRUJAN MINGW64 ~
$ Choose an option:
1. Push
2. Pop
$ Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 1
Enter value to push: 10
Pushed 10

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 1
Enter value to push: 20
Pushed 20

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 3
Stack elements: 10 20

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 2
Popped 20

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 3
Stack elements: 10

Choose an option:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 4
```

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

Observation:

Circular queues

1) Insertion, Deletion, display

```
struct Cqueue Q {
    int * arr;
    int size;
    int f;
    int r;
};

void initialize (struct Q * q, int n) {
    q->arr = (int *) malloc (n * sizeof(int));
    q->size = n;
    q->f = -1;
    q->r = -1;
}

bool isEmpty ( struct Q * q) {
    return q->f == -1 && q->r == -1 ;
}

bool isFull ( struct Q * q ) {
    return q->(r+1) % (q->size) == q->f ;
}

void insertion ( struct Q * q, int data) {
    if (!isFull(q)) {
        q->f = 0; // make f = 0; }
        q->r = q->(r+1) % (q->size) ;
        q->arr[q->r] = data;
    } else {
    printf(" Overflow ");
    }
}
```

```
~~void~~ int deletion(struct Q * q) {
    ~~if (q->size==~~
    if (!isEmpty(q)) {
        q->f = (q->f+1) % (q->size);
        int ele = q->arr[q->f];
        return ele;
    } else {
    return -1;
    }
}

void display(struct Q * q) {

for (int i=q->f ; i!=q->r ; i=(i+1)% (q->size
    printf("%d\n", q->arr[i]);
    }

void main() {
struct Q * q =(struct Q *) malloc( sizeof(struct Q
 initialize(q, 5);
 insertion(q, 6);
 insertion (q, 8);
 deletion (q);
 display(q);

}
```

Switch case

~~insertion~~ if

Output

1) Insert
2) Delete
3. Display
4. Exit

1 ↵
Enter value to insert : 5 ↵
1 ↵
Enter value to insert : 4 ↵
1 ↵
Enter value to insert : 8 ↵
1 ↵
Enter value to insert : 4 ↵

"Queue Overflow"
3. Queue elements 5 4 8 4
2. Deleted value 5
2. Deleted value 4
2. Deleted value 8.
2 Deleted value 4
2. "Queue underflow"

Executed

Code:

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

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

void insert(int val) {
   if ((front == 0 && rear == MAX - 1) || (front == rear + 1)) {
      printf("Queue Overflow\n");
   } else {
      if (front == -1) {
         front = rear = 0;
      } else if (rear == MAX - 1) {
         rear = 0;
      } else {
         rear++;
      }
      queue[rear] = val;
      printf("Inserted %d\n", val);
   }
}

void delete() {
   if (front == -1) {
      printf("Queue Underflow\n");
   } else {
```

```
        printf("Deleted %d\n", queue[front]);
        if (front == rear) {
            front = rear = -1;
        } else if (front == MAX - 1) {
            front = 0;
        } else {
            front++;
        }
    }
}

void display() {
    if (front == -1) {
        printf("Queue is Empty\n");
    } else {
        printf("Queue elements: ");
        if (rear >= front) {
            for (int i = front; i <= rear; i++) printf("%d ", queue[i]);
        } else {
            for (int i = front; i < MAX; i++) printf("%d ", queue[i]);
            for (int i = 0; i <= rear; i++) printf("%d ", queue[i]);
        }
        printf("\n");
    }
}

int main() {
    int choice, value;
    while (1) {
```

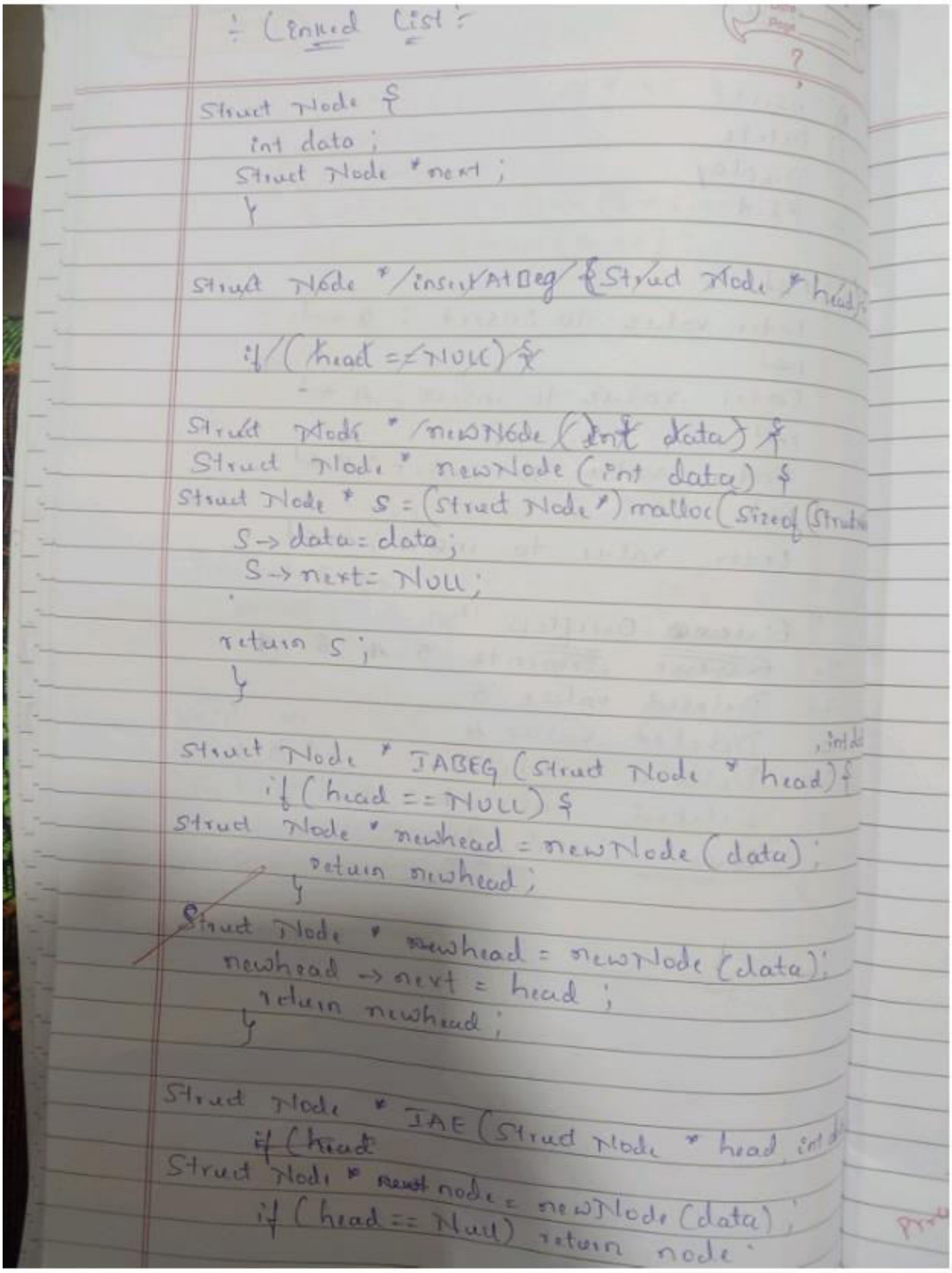
```
        printf("\nCircular Queue Operations:\n1. Insert\n2. Delete\n3. Display\n4. Exit\nEnter your choice: ");
        scanf("%d", &choice);
        switch (choice) {
            case 1:
                printf("Enter value to insert: ");
                scanf("%d", &value);
                insert(value);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

Output:

```
srujan  R@SRUJAN MINGW64 ~
$ Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter value to insert: 10
Inserted 10

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter value to insert: 20
Inserted 20

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter value to insert: 30
Inserted 30

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 3
Queue elements: 10 20 30

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 2
Deleted 10

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 3
Queue elements: 20 30

Circular Queue Operations:
1. Insert
2. Delete
3. Display
4. Exit
Enter your choice: 1
Enter value to insert: 40
Inserted 40
```

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

Observation:



÷ Linked List ÷

```
Struct Node {
  int data ;
  Struct Node *next ;
}

Struct Node */insertAtBeg/ (Struct Node * head)

if/(head =/ NULL) {

Struct Node * /newNode (int data) {
Struct Node * newNode (int data) {
Struct Node * s = (Struct Node *) malloc( sizeof (Struct
  s -> data = data ;
  s -> next = NULL ;

  return s ;
}

Struct Node * IABEG (Struct Node * head, int data) {
  if (head == NULL) {
Struct Node * newhead = newNode (data) ;
  return newhead ;
  }
Struct Node * newhead = newNode (data) ;
newhead -> next = head ;
  return newhead ;
}

Struct Node * IAE (Struct Node * head, int d
  if (head
Struct Node * node = newNode (data) ;
  if (head == Null) return node ;
```

Linked List

Insert

Accessing

While
```
Struct Node *s = head;
  While (s->next != NULL) {
        s = s->next;
    }
    s->next = node;
    return head;
}

Void display (Struct Node * head) {
  Struct Node *s
  if (head == NULL) {
      printf (" Empty ");
  } else {
  While (s->next != NULL) {
     printf (" %d ", s->data);
         s = s->next;
     }
     printf (" \n ");
}

Void main() {
Struct Node * head 0 = newNode(5);
Struct Node * first 0 = newNode(6);
Struct Node * Second 0 = newNode(7);

head->next = first;
first->next = Second;

IABEG (head, 6);
IAE (head, 12);

display(head);

}
```

O/P

Enter your choice: 1
Choose an option
1) Insert at Beginning
2) Insert at End
3) Print List
4) Exit

1) Enter data to insert at beginning: 1
1) Enter data to insert at beginning: 2
1) Enter data to insert at beginning: 3
1) Enter data to insert at beginning 4

2) Enter data 5
2) Enter data 6

3) 4 -> 3 -> 2 -> 1 -> 5 -> 6 -> NULL

4) Exitting...

—— || Code execution Successful || ——

Code:

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

// Node structure for Singly Linked List
struct Node {
    int data;
    struct Node* next;
};

struct Node* head = NULL;

// Create a linked list
void createLinkedList(int n) {
    struct Node *newNode, *temp;
    int data, i;

    for (i = 0; i < n; i++) {
        printf("Enter data for node %d: ", i + 1);
        scanf("%d", &data);

        newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = NULL;

        if (head == NULL) {
            head = newNode;
        } else {
            temp = head;
```

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

// Insert at the beginning
void insertAtBeginning(int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = head;
    head = newNode;
    printf("Node inserted at the beginning.\n");
}

// Insert at a specific position
void insertAtPosition(int data, int position) {
    struct Node *newNode, *temp;
    int i;

    newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;

    if (position == 1) {
        newNode->next = head;
        head = newNode;
    } else {
```

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

        if (temp != NULL) {
            newNode->next = temp->next;
            temp->next = newNode;
            printf("Node inserted at position %d.\n", position);
        } else {
            printf("Position out of range.\n");
        }
    }
}

// Insert at the end
void insertAtEnd(int data) {
    struct Node *newNode, *temp;

    newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = NULL;

    if (head == NULL) {
        head = newNode;
    } else {
        temp = head;
        while (temp->next != NULL) {
            temp = temp->next;
```

```
        }
        temp->next = newNode;
    }
    printf("Node inserted at the end.\n");
}

// Display the linked list
void displayList() {
    struct Node* temp = head;

    if (head == NULL) {
        printf("The list is empty.\n");
    } else {
        printf("Linked list contents: ");
        while (temp != NULL) {
            printf("%d -> ", temp->data);
            temp = temp->next;
        }
        printf("NULL\n");
    }
}

int main() {
    int choice, data, position, n;

    while (1) {
        printf("\nSingly Linked List Operations:\n");
        printf("1. Create Linked List\n2. Insert at Beginning\n3. Insert at Position\n4. Insert at
End\n5. Display List\n6. Exit\n");
        printf("Enter your choice: ");
```

```
scanf("%d", &choice);

switch (choice) {
  case 1:
    printf("Enter the number of nodes: ");
    scanf("%d", &n);
    createLinkedList(n);
    break;
  case 2:
    printf("Enter data to insert at beginning: ");
    scanf("%d", &data);
    insertAtBeginning(data);
    break;
  case 3:
    printf("Enter data to insert: ");
    scanf("%d", &data);
    printf("Enter position: ");
    scanf("%d", &position);
    insertAtPosition(data, position);
    break;
  case 4:
    printf("Enter data to insert at end: ");
    scanf("%d", &data);
    insertAtEnd(data);
    break;
  case 5:
    displayList();
    break;
  case 6:
```

```
            return 0;

          default:

            printf("Invalid choice!\n");

        }

    }

}
```

Output:

```
$ Singly Linked List Operations:
1.Singly Linked List Operations:
1. Create Linked Listg
2. Insert at Beginning
3. Insert at Position
4. Insert at End
5. Display List
6. Exitour choice: 1
Enter your choice: 1nodes: 3
Enter the number of nodes: 3
Enter data for node 1: 10
Enter data for node 2: 20
Enter data for node 3: 30
Singly Linked List Operations:
Singly Linked List Operations:
1. Create Linked Listg
2. Insert at Beginning
3. Insert at Position
4. Insert at End
5. Display List
6. Exitour choice: 2
Enter your choice: 2 at beginning: 5
Enter data to insert at beginning: 5
Node inserted at the beginning.
Singly Linked List Operations:
Singly Linked List Operations:
1. Create Linked Listg
2. Insert at Beginning
3. Insert at Position
4. Insert at End
5. Display List
6. Exitour choice: 3
Enter your choice: 3: 25
Enter data to insert: 25
Enter position: 3position 3.
Node inserted at position 3.
Singly Linked List Operations:
Singly Linked List Operations:
1. Create Linked Listg
2. Insert at Beginning
3. Insert at Position
4. Insert at End
5. Display List
6. Exitour choice: 4
Enter your choice: 4 at end: 40
Enter data to insert at end: 40
Node inserted at the end.
Singly Linked List Operations:
Singly Linked List Operations:
1. Create Linked Listg
2. Insert at Beginning
3. Insert at Position
4. Insert at End
5. Display List
6. Exitour choice: 5
Enter your choice: 5: 5 -> 10 -> 20 -> 25 -> 30 -> 40 -> NULL
Linked list contents: 5 -> 10 -> 20 -> 25 -> 30 -> 40 -> NULL
Singly Linked List Operations:
Singly Linked List Operations:
1. Create Linked Listg
2. Insert at Beginning
3. Insert at Position
4. Insert at End
5. Display List
6. Exitour choice: 6
```

5. WAP to Implement Singly Linked List with following operations a) Create a linked list. b) Deletion of first element, specified element and last element in the list. c) Display the contents of the linked list

Observation:

11/11/24

WAP to Implement LL
i) Create a LL
ii) Deletion of 1st ele, Specified ele & last ele
c) Display

```
#include <stdio.h>
#include <stdlib.h>
#include <stdbool.h>
Struct Node {
  int data;
  Struct Node * next;
  };

bool
Voi Struct Node * newnode (int data);
Struct Node * S = (Struct Node *)malloc (Size of
          Struct Node ));
  S -> data = data;
  S -> next = null;
  return S;
  }

bool isEmpty (Struct Node * head) {
   return head == null;
  }

~~bool isFull (Struct Node * head) {~~

Struct Node * deletefirst (Struct Node * head){
  if (!isEmpty(head)) {
        ~~head = head~~
  Struct Node * ptr = head;
        head = head -> next;
        free(ptr);
        return head; }
```

```
Struct Node* dlast(Struct Node* head) {
 Struct Node* prev = head;
 Struct Node* ptr = head->next;

  if (! is Empty (head)) {
     While( ptr->next != null) {
          ptr = ptr -> next;
          head = prev -> next;
          prev -> next = null;
          free(ptr);
          return head;
     }
  }
```

```
Struct Node * dspecificdele (Struct Node * head,
                               int ele) {
Struct node * ptr= head ;
   While (ptr -> data = = ele) {
        ptr = ptr -> next ;
     }
   While(
   Struct Node * prev = head ;
   While ( ptr -> next = = ptr) {
           prev = prev -> next ;
     }

  prev -> next = ptr -> next ;
   free(ptr);
   return head ;
}

void main () {
   insert (2);
   insert (3);
   insert (4);

 deletedele (4, head);
 delLast (head);
 deletef (head);

}
```

O/P

1 → 2 → 3 → 4 → 5

1) Delete first element
   2 → 3 → 4 → 5

2) Delete specified ele 4
   2 → 3 → 5

3) Delete last ele

Code:

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

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

struct Node* head = NULL;

void createLinkedList(int n) {
    struct Node *newNode, *temp;
    int data, i;

    for (i = 0; i < n; i++) {
        printf("Enter data for node %d: ", i + 1);
        scanf("%d", &data);

        newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = NULL;

        if (head == NULL) {
            head = newNode;
        } else {
            temp = head;
            while (temp->next != NULL) {
                temp = temp->next;
```

```
            }
            temp->next = newNode;
        }
    }
}

void deleteFirst() {
    if (head == NULL) {
        printf("The list is empty. No node to delete.\n");
        return;
    }
    struct Node* temp = head;
    head = head->next;
    free(temp);
    printf("First node deleted.\n");
}

void deleteSpecified(int key) {
    if (head == NULL) {
        printf("The list is empty. No node to delete.\n");
        return;
    }

    struct Node *temp = head, *prev = NULL;

    if (temp != NULL && temp->data == key) {
        head = temp->next;
        free(temp);
        printf("Node with data %d deleted.\n", key);
```

```
        return;
    }

    while (temp != NULL && temp->data != key) {
        prev = temp;
        temp = temp->next;
    }

    if (temp == NULL) {
        printf("Node with data %d not found.\n", key);
        return;
    }

    prev->next = temp->next;
    free(temp);
    printf("Node with data %d deleted.\n", key);
}

void deleteLast() {
    if (head == NULL) {
        printf("The list is empty. No node to delete.\n");
        return;
    }

    struct Node *temp = head, *prev = NULL;

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

```
        printf("Last node deleted.\n");
        return;
    }

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

    prev->next = NULL;
    free(temp);
    printf("Last node deleted.\n");
}

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

    if (head == NULL) {
        printf("The list is empty.\n");
    } else {
        printf("Linked list contents: ");
        while (temp != NULL) {
            printf("%d -> ", temp->data);
            temp = temp->next;
        }
        printf("NULL\n");
    }
}
```

```
int main() {
    int choice, data, n;

    while (1) {
        printf("\nSingly Linked List Operations:\n");
        printf("1. Create Linked List\n2. Delete First\n3. Delete Specified\n4. Delete Last\n5.
Display List\n6. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter the number of nodes: ");
                scanf("%d", &n);
                createLinkedList(n);
                break;
            case 2:
                deleteFirst();
                break;
            case 3:
                printf("Enter the value to delete: ");
                scanf("%d", &data);
                deleteSpecified(data);
                break;
            case 4:
                deleteLast();
                break;
            case 5:
                displayList();
                break;
```

```
            case 6:
                return 0;
            default:
                printf("Invalid choice!\n");
        }
    }
}
```

Output:

```
srujan  R@SRUJAN MINGW64 ~
$ Singly Linked List Operations:
1. Create Linked List
2. Delete First
3. Delete Specified
4. Delete Last
5. Display List
6. Exit
Enter your choice: 1
Enter the number of nodes: 3
Enter data for node 1: 10
Enter data for node 2: 20
Enter data for node 3: 30

Singly Linked List Operations:
1. Create Linked List
2. Delete First
3. Delete Specified
4. Delete Last
5. Display List
6. Exit
Enter your choice: 5
Linked list contents: 10 -> 20 -> 30 -> NULL

Singly Linked List Operations:
1. Create Linked List
2. Delete First
3. Delete Specified
4. Delete Last
5. Display List
6. Exit
Enter your choice: 2
First node deleted.

Singly Linked List Operations:
1. Create Linked List
2. Delete First
3. Delete Specified
4. Delete Last
5. Display List
6. Exit
Enter your choice: 5
Linked list contents: 20 -> 30 -> NULL

Singly Linked List Operations:
1. Create Linked List
2. Delete First
3. Delete Specified
4. Delete Last
5. Display List
6. Exit
Enter your choice: 3
Enter the value to delete: 30
Node with data 30 deleted.

Singly Linked List Operations:
1. Create Linked List
2. Delete First
3. Delete Specified
4. Delete Last
5. Display List
6. Exit
Enter your choice: 5
Linked list contents: 20 -> NULL
```

6. WAP to Implement Single Link List with following operations: Sort the linked list, Reverse the linked list, Concatenation of two linked lists, Implement Single Link List to simulate Stack & Queue Operations.

Observation:

Lab - 7

W.A.p to implement LL with following operations.

(i) Sort (ii) Reverse (iii) Concatenate.

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

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

struct node * Createlinkedlist () {
    struct node * head = Null;
    struct node * temp = Null;
    struct node * newNode;
    int n, value;
    printf("Number of elements");
    scanf("%d", &n);
    for (int i=0; i<n; i++) {
        printf("Enter");
        scanf("%d", &value);

    newNode = (struct node *) malloc(sizeof
                (struct node));
    newnode -> data = Value;
    newNode -> next = Null;

    if (head == Null) {
        head = newNode;
    } else {
        temp -> next = newNode;
    }
    temp = newNode }
```

```
return head ;
}

void SortLinkedList (Struct Node* head) {
    if ( *head = = Null) return ;
  Struct Node * Currenthead = *head ;
  Struct Node * index = Null ;
  int temp ;

While (current != Null) {
    index = Current -> null ;
  While (index != Null) {
      if (Current -> data > index -> data) {
    temp = Current -> data ;
    Current -> data = index -> data ;
    index -> data = data temp ;
    }
   index = index -> next ;
   }
   Current = Current -> next ;
 }
}

Void reverselinkedList ( Struct Node * head) {
 Struct node * prev = Null ;
 * Current = * head ;
 * next = Null ;
  While (Current != Null) {
    next = Current -> next ;
    Current -> next = prev ;
    prev = Current ;
    Current = next ;
  }
```

```
struct node * Concatenatelist (struct node
 head1, struct node * head) {
  if (head != NULL) return head2;
   if (head2 == NULL) return head1;

  struct node * temp = head1;
  While (temp->next != NULL) {
        temp = temp -> next ; }
  temp ->next = head2;
   return head1 ;
 }

Void main() {

  // switch case
    CreateLinkedList() ;
    SortLinkedList() ;
 }  reverse linked list() ;
    Concatenate_list() ;
    }
```

O/P

2/12

O/P

(i) Enter values for list1 : 1 2 3 4 5 6

(ii) Enter values for list2 : 1 2 3 4 5 6

(iii) Sort reverse list1 : 6 5 4 3 2 1

IV Concatenate 1 & 2 1 2 3 4 5 6 6 5 4 3 2 1

V Sortlist : 1 1 2 2 3 3 4 4 5 5 6 6

V Displaylist :

1 1 2 2 3 3 4 4 5 5 6 6

Code:

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

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

struct Node* head = NULL;

void insertAtEnd(int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    struct Node* temp;
    newNode->data = data;
    newNode->next = NULL;
    if (head == NULL) {
        head = newNode;
    } else {
        temp = head;
        while (temp->next != NULL) {
            temp = temp->next;
        }
        temp->next = newNode;
    }
}

void sortList() {
    struct Node* i;
```

```
    struct Node* 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;
            }
        }
    }
    printf("Linked list sorted.\n");
}

void reverseList() {
    struct Node *prev = NULL, *current = head, *next = NULL;
    while (current != NULL) {
        next = current->next;
        current->next = prev;
        prev = current;
        current = next;
    }
    head = prev;
    printf("Linked list reversed.\n");
}

void concatenateLists(struct Node* head1, struct Node* head2) {
    if (head1 == NULL) {
        head = head2;
```

```
        return;
    }
    struct Node* temp = head1;
    while (temp->next != NULL) {
        temp = temp->next;
    }
    temp->next = head2;
    head = head1;
    printf("Linked lists concatenated.\n");
}

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

int main() {
    int choice, data, n, i;
    struct Node *list1 = NULL, *list2 = NULL;
```

```
    while (1) {
        printf("\nSingly Linked List Operations:\n");
        printf("1. Insert at End\n2. Sort List\n3. Reverse List\n4. Concatenate Two Lists\n5.
Display List\n6. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter data to insert at end: ");
                scanf("%d", &data);
                insertAtEnd(data);
                break;
            case 2:
                sortList();
                break;
            case 3:
                reverseList();
                break;
            case 4:
                printf("Enter number of nodes for first list: ");
                scanf("%d", &n);
                for (i = 0; i < n; i++) {
                    printf("Enter data for node %d of list1: ", i + 1);
                    scanf("%d", &data);
                    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
                    newNode->data = data;
                    newNode->next = list1;
                    list1 = newNode;
                }
```

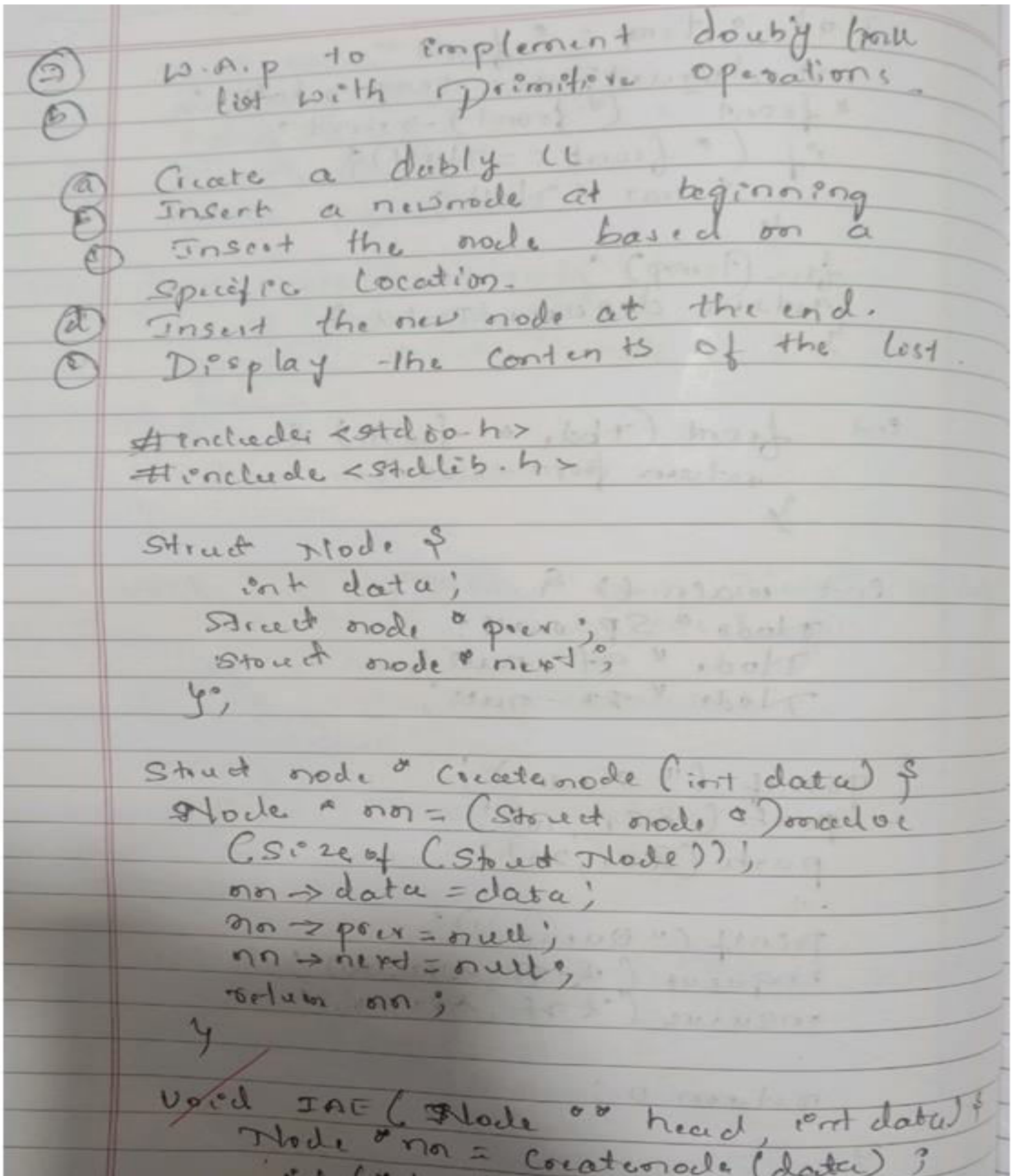
```
            printf("Enter number of nodes for second list: ");
            scanf("%d", &n);
            for (i = 0; i < n; i++) {
                printf("Enter data for node %d of list2: ", i + 1);
                scanf("%d", &data);
                struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
                newNode->data = data;
                newNode->next = list2;
                list2 = newNode;
            }
            concatenateLists(list1, list2);
            break;
        case 5:
            displayList();
            break;
        case 6:
            return 0;
        default:
            printf("Invalid choice!\n");
        }
    }
}
```

Output:

```
srujan  R@SRUJAN MINGW64 ~
$ Singly Linked List Operations:
1. Insert at End
2. Sort List
3. Reverse List
4. Concatenate Two Lists
5. Display List
6. Exit
Enter your choice: 1
Enter data to insert at end: 10

Singly Linked List Operations:
1. Insert at End
2. Sort List
3. Reverse List
4. Concatenate Two Lists
5. Display List
6. Exit
Enter your choice: 1
Enter data to insert at end: 20

Singly Linked List Operations:
1. Insert at End
2. Sort List
3. Reverse List
4. Concatenate Two Lists
5. Display List
6. Exit
Enter your choice: 5
Linked list contents: 10 -> 20 -> NULL

Singly Linked List Operations:
1. Insert at End
2. Sort List
3. Reverse List
4. Concatenate Two Lists
5. Display List
6. Exit
Enter your choice: 2
Linked list sorted.

Singly Linked List Operations:
1. Insert at End
2. Sort List
3. Reverse List
4. Concatenate Two Lists
5. Display List
6. Exit
Enter your choice: 5
Linked list contents: 10 -> 20 -> NULL

Singly Linked List Operations:
1. Insert at End
2. Sort List
3. Reverse List
4. Concatenate Two Lists
5. Display List
6. Exit
Enter your choice: 3
Linked list reversed.

Singly Linked List Operations:
1. Insert at End
2. Sort List
3. Reverse List
4. Concatenate Two Lists
Linked list contents: 5 -> 15 -> 25 -> 30 -> NULL
```

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

Observation:



W.A.P to implement doubly link list with primitive operations.

a) Create a doubly LL
b) Insert a newnode at beginning
c) Insert the node based on a specific location.
d) Insert the new node at the end.
e) Display the contents of the list.

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

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

struct node *createnode (int data) {
 Node *nn = (struct node *)malloc
    (sizeof (struct Node));
    nn -> data = data;
    nn -> prev = null;
    nn -> next = null;
    return nn;
}

void IAF ( Node **head, int data) {
  Node *nn = createnode (data);
    if (*head == null) {
      *head = newnode;
      return;
    }
```

```
struct Node * temp = * head;
  While (temp -> next != null) temp = temp->next;
  temp -> next = newnode;
} nn -> prev = temp;

Void IAL ( Node * head, int data, int la){
  struct Node * nn = CreateNode(data);
    if (loc == 0) {
      IAB (head, data);
    return;
    }
}

Void displayList (struct Node * head) {
  Struct Node * temp = head;
  While (temp != null) {
  printf ("-1.d", temp -> data);
    temp = temp -> next;
  }
}

Int main () {
  Node * head = null;

  IAB (&head, 10);
  IAB (&head, 20);
  IAE (&head, 30);
  AAL (&head, 25, 2);

  display list (head);
  return 0;
  }
```

O/P

1) IAB
2) IAE
3) IAL
4) Display
5 Exit

1) 5
1) 6
1) 7

2) 8
2) 9
2) 12

4) 5 6 7 12 9 8

5) Exitting

3) IAL
Index 3

5 6 7 12 3 9 8

5) Exit

Code:

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

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

struct DoublyLinkedList {
    struct Node* head;
};

void createList(struct DoublyLinkedList* dll, int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->prev = newNode->next = NULL;

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

```
}

void insertLeft(struct DoublyLinkedList* dll, int newData, int existingData) {
    struct Node* temp = dll->head;
    while (temp != NULL && temp->data != existingData) {
        temp = temp->next;
    }

    if (temp != NULL) {
        struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = newData;
        newNode->next = temp;
        newNode->prev = temp->prev;

        if (temp->prev != NULL) {
            temp->prev->next = newNode;
        } else {
            dll->head = newNode;
        }
        temp->prev = newNode;
    } else {
        printf("Node with data %d not found.\n", existingData);
    }
}

void deleteNode(struct DoublyLinkedList* dll, int value) {
    struct Node* temp = dll->head;

    while (temp != NULL && temp->data != value) {
```

```
        temp = temp->next;
    }

    if (temp == NULL) {
        printf("Node with value %d not found.\n", value);
        return;
    }

    if (temp->prev != NULL) {
        temp->prev->next = temp->next;
    } else {
        dll->head = temp->next;
    }

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

    printf("Node with value %d deleted.\n", value);
}

void display(struct DoublyLinkedList* dll) {
    if (dll->head == NULL) {
        printf("List is empty.\n");
        return;
    }

    struct Node* temp = dll->head;
    while (temp != NULL) {
```

```
        printf("%d ", temp->data);
        temp = temp->next;
    }
    printf("\n");
}

int main() {
    struct DoublyLinkedList dll;
    dll.head = NULL;

    createList(&dll, 10);
    createList(&dll, 20);
    createList(&dll, 30);
    createList(&dll, 40);

    printf("Original List:\n");
    display(&dll);

    insertLeft(&dll, 25, 30);
    printf("List after inserting 25 to the left of 30:\n");
    display(&dll);

    deleteNode(&dll, 20);
    printf("List after deleting node with value 20:\n");
    display(&dll);

    deleteNode(&dll, 50);
    return 0;
}
```

Output:

```
srujan  R@SRUJAN MINGW64 ~
$ Original List:
10 20 30 40
List after inserting 25 to the left of 30:
10 20 25 30 40
List after deleting node with value 20:
10 25 30 40
Node with value 50 not found.
```

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.

Observation:

1) To Construct a BST
2) To traverse using 3 traversal methods
3) To display

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

struct node {
  int data;
  struct node * L;
  struct node * R;
};

Struct node * createNode() {
  Struct node * p = (Struct node *) malloc(sizeof
    (Struct node));
}

Struct node * insertion(Struct node * root, int data
  Struct node * n = createNode();
  if (root == Null) return n;
else if(data < root -> data) {
      root -> left = (insertion(root -> left, data));
  }
else if (data > root -> data) {
      root -> right = (insertion(root -> right, data));
  }
}
```

```
void preorder (Struct node * root) {
    if (root != Null) {
        printf (* root -> data);
        preorder (root -> left);
        preorder (root -> right);
    }
}

Void inorder ( Struct node * root) {
    if ( root != null) {
    inorder ( root -> left) ;
    printf (root -> data);
    inorder (root -> right);
    }

Void postorder (Struct node * root) {
    if (root != null) {
    postorder (root -> left);
    postorder (root -> right);
    printf ( root -> data);
}

int main () {
    Struct node * root = Null;
    root = insertion (root, 5);
    root = insertion (root, 6);

    inorder ( root );
    preorder ( root );
    postorder ( root );

    return 0;
}
```

O/P

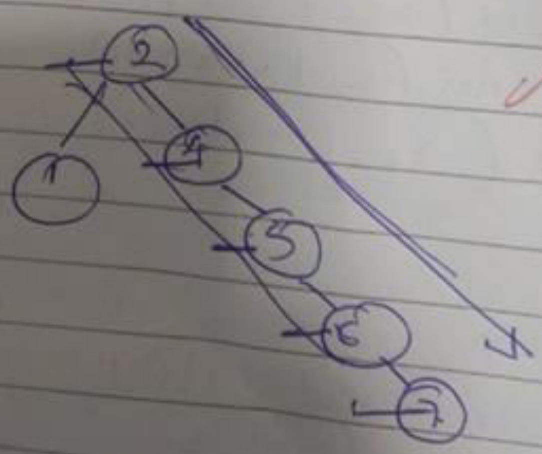
1) Insert
2. preorder
3. Inorder
4. postorder

1) 2 4 5 6 7

2. 2 1 4 5 6 7 : preorder

3. 1 2 4 5 6 7 : Inorder

4. 1 7 6 5 4 2 : postorder



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 = 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;
}
```

```c
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);
   }
}

void display(struct Node* root) {
   if (root != NULL) {
      printf("Inorder: ");
      inorder(root);
      printf("\n");
```

```
        printf("Preorder: ");
        preorder(root);
        printf("\n");

        printf("Postorder: ");
        postorder(root);
        printf("\n");
    }
}

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

    do {
        printf("Binary Search Tree Operations:\n");
        printf("1. Insert Element\n");
        printf("2. Display Elements\n");
        printf("3. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1:
                printf("Enter value to insert: ");
                scanf("%d", &value);
                root = insert(root, value);
                break;
```

```
        case 2:
          if (root == NULL) {
            printf("Tree is empty.\n");
          } else {
            display(root);
          }
          break;

        case 3:
          printf("Exiting...\n");
          break;

        default:
          printf("Invalid choice, please try again.\n");
      }
  } while (choice != 3);

  return 0;
}
```

Output:

```
srujan  R@SRUJAN MINGW64 ~
$ Binary Search Tree Operations:
1. Insert Element
2. Display Elements
3. Exit
Enter your choice: 1
Enter value to insert: 50

Binary Search Tree Operations:
1. Insert Element
2. Display Elements
3. Exit
Enter your choice: 1
Enter value to insert: 30

Binary Search Tree Operations:
1. Insert Element
2. Display Elements
3. Exit
Enter your choice: 1
Enter value to insert: 70

Binary Search Tree Operations:
1. Insert Element
2. Display Elements
3. Exit
Enter your choice: 2
Inorder: 30 50 70
Preorder: 50 30 70
Postorder: 30 70 50

Binary Search Tree Operations:
1. Insert Element
2. Display Elements
3. Exit
Enter your choice: 3
Exiting...
```

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

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

Observation:

BFS & check my graph is Connected or not

```
void bfs ( int graph[max][max],
    int start, int visited[max] , int
    vertices) {

  struct Queue q ;
  q.front = q.rear = -1 ;
  enqueue (&q, start) ;
  visited (start]=1 ;

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

   for (int i = 0 ; i < vertices ;i++ ) {
    if ( graph [node] [i] == 1 && !visited[i]){
      visited [i]=1 ;
      enqueue (&q, i) ;
      }
     }
    }
  }
```

```
void dfs (int graph[max][max], int node,
    int visited[max], int vertices) {

    visited[node] = 1;
    printf("%d ", node);

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

int isConnected (int graph[max][max],
                 int vertices) {

    int visited[max] = {0};
    dfs (graph, 0, visited, vertices);

    for (int i=0; i< vertices; i++) {
        if (visited[i]==0)
            return 0;
    }
    return 1;
}

int main() {
// defining graph;
Switch cases

}
```

1) BFS

1 5 3 2 6 4

2) DFS

1 3 5 2 6 4

3) is connected
graph is connected.

23/12

Code:

```
#include <stdio.h>
#include <stdlib.h>
#define MAX 10
struct Queue {
    int items[MAX];
    int front;
    int rear;
};

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

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

bool isFull(struct Queue* q) {
    return q->rear == MAX - 1;
}

void enqueue(struct Queue* q, int value) {
    if (isFull(q)) {
        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 visited[MAX], int start, int n) {
    struct Queue q;
    initQueue(&q);
    enqueue(&q, start);
    visited[start] = 1;

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

        for (int i = 0; i < n; i++) {
            if (graph[current][i] == 1 && !visited[i]) {
```

```
            enqueue(&q, i);
            visited[i] = 1;
          }
        }
    }
}


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

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

int isConnected(int graph[MAX][MAX], int n) {
    int visited[MAX] = {0};
    DFS(graph, visited, 0, n);

    for (int i = 0; i < n; i++) {
        if (!visited[i]) {
            return 0;  // Not connected
        }
    }
    return 1;  // Connected
```

```
}

int main() {
   int graph[MAX][MAX] = {0};
   int n, edges, u, v;

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

   for (int i = 0; i < edges; i++) {
      printf("Enter edge (u v): ");
      scanf("%d %d", &u, &v);
      graph[u][v] = 1;
      graph[v][u] = 1;  // For undirected graph
   }

   if (isConnected(graph, n)) {
      printf("The graph is connected.\n");
   } else {
      printf("The graph is not connected.\n");
   }

   return 0;
}
```

Output:

```
srujan  R@SRUJAN MINGW64 ~
$ Enter the number of vertices: 5
Enter the number of edges: 4
Enter edge (u v): 0 1
Enter edge (u v): 0 2
Enter edge (u v): 1 3
Enter edge (u v): 2 4
BFS traversal starting from vertex 0: 0 1 2 3 4
```

```
srujan  R@SRUJAN MINGW64 ~
$ Enter the number of vertices: 5
Enter the number of edges: 4
Enter edge (u v): 0 1
Enter edge (u v): 0 2
Enter edge (u v): 1 3
Enter edge (u v): 2 4
0 1 3 2 4
```