VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

DATA STRUCTURE LAB RECORD

Submitted by

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Under the Guidance of

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BMSCE

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,

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(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the LAB RECORD carried out by **SHREYAS KS (1BM18CS104)** who is the bonafide students 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 Visveswaraiah Technological University, Belgaum during the year 2020-2021. The lab report has been approved as it satisfies the academic requirements in respect of **DATA STRUCTURE LAB RECORD (19CS3PCDST)** work prescribed for the said degree.

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1._____ _____

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INDEX

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

Date __/__/__
Page
SPLASH

Lab program -1

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

a) Push
b) Pop
c) Display

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

```
#include <stdio.h>
#include <stdlib.h>
#define Max 5
int top = -1
int s[10];
int item;
void push()
{
 if (top == Max -1)
 {
 printf("STACK Overflow elements
        cannot be added\n");
  return;
 }
top += 1;
s[top] = item;
}
int pop()
{
  if top== -1)
```

```
{
 return -1;
}
return s[top--];
}
void display()
{
 if (top == -1)
{
 printf ("Stack is empty no item
          can be printed\n");
 return;
}
else
{
 for (int i = top; i > 0; i--)
{
 printf ("%d\n", s[i]);
}
}
}
int main()
{
int item_deleted;
int choice;
for (;;)
{
printf ("\n ***** Stack Menue *****\n");
printf ("1: push\n 2: pop\n 3: display
         \n 4: Exit")
printf ("Enter the item to be
         inserted\n");
```

```
Scanf ("%d", &choice);
Switch (choice)
{
case 1:
printf("Enter the item to be
        inserted \n");
Scanf ("%d", &item);
push ();
break;

case 2:
item_deleted = pop();
if (item_deleted == -1)
printf ("Stack is empty \n");
else {
printf ("Deleted item is %d \n",
        item_deleted);
}
break;

case 3:
printf ("Elements of stack are \n");
display();
break;

default:
exit (0);
}
}
```

```
#include<stdio.h>
#include<stdlib.h>
#define Max 5
int top=-1;
int s[10];
int item;
void push()
{
if(top==Max-1)
{
printf("STACK OVERFLOW ELEMENT CANNOT BE ADDED\n");
return;
}
top+=1;
s[top]=item;
}
int pop()
{
if(top==-1)
{
```

```
return -1;
}
return s[top--];
}
void display()
{
if(top==-1)
{
printf("STACK IS EMPTY NO ITEM CAN BE PRINTED\n"); return;
}
else
{
for(int i=top;i>=0;i--)
{
printf("%d\n",s[i]);
}
}
}
int main()
{
```

```
int item_deleted;
int choice;
for(;;)
{
printf("\n1:push\n2:pop\n3:display\n4:exit\n");
printf("Enter your choice\n");
scanf("%d",&choice);
switch(choice)
{
case 1:
printf("Enter the item to be inserted\n");
scanf("%d",&item);
push();
break;
case 2:
item_deleted=pop();
if(item_deleted==-1)
printf("Stack is empty\n");
else{
```

```
printf("Deleted item is %d\n",item_deleted);
}
break;
case 3:


printf("Elements of stack are \n");

display();

break;

default:

exit(0);

}

}
```

}

OUTPUT:

```
PS C:\Users\It's mine!\Desktop\C C++> cd "c:\Users\It's mine!\Desktop\C C++\.vscode\" ; if ($?) { gcc sss.c -o sss } ; if ($?) { .\sss }
***Stack Menue***
1:push
2:pop
3:display
4:exit
Enter any number between 1 to 4
1
Enter the item to be inserted
45
***Stack Menue***
1:push
2:pop
3:display
4:exit
Enter any number between 1 to 4
3
Elements of stack are
45
***Stack Menue***
1:push
2:pop
3:display
4:exit
Enter any number between 1 to 4
2
Deleted item is 45
***Stack Menue***
1:push
2:pop
3:display
4:exit
Enter any number between 1 to 4
3
Elements of stack are
STACK IS EMPTY NO ITEM CAN BE PRINTED
***Stack Menue***
1:push
2:pop
3:display
4:exit
```

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)

Date / /
Page
SPLASH

Lab Program - 2

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

Soln.

```
#include <stdio.h>
#define N 100
int stack[N];
int top = -1;

void push(int item) {
    if (top == N-1)
        printf("Stack overflow!\n");
    else
        stack[++top] = item;
}
int pop() {
    if (top == -1)
        printf("Stack underflow!\n");
    else
        return stack[top--];
}
int priority(char op) {
    switch(op) {
    case '*': return 2;
              break;
    case '/': return 2;
              break;
```

```
        case '+' : return 1;
                   break;
        case '-' : return 1;
                   break;
        case '(' : return 0;
                   break;
    }
}
int main()
{
    char s[50];
    char t[50];
    int i;
    int choice = 1;

    do {
        i = 0;
        printf("Enter your infix expression:
               ");
        scanf("%s", s);
        for (int i=0; s[i] != '\0'; i++) {
          switch (s[i]) {
            case '(' : push('(');
                       break;
            case ')' : while (stack[top] != '(')
              {
                t[i++] = pop();
              }
              pop();
              break;
            case '*';
            case '/' :
```

```
        case '+':
        case '-': while (top != -1 &&
                  priority (stack[top]) >=
                  priority (s[i])) {
                    t[j++] = pop ();
                  }
                  push (s[i]);
                  break;
        default : t[j++] = s[i];
        }
    }
while (top != -1) {
        t[j++] = pop ();
    }
t[j] = '\0';
printf ("Postfix expression for \"%s\"
        is \"%s\".\n", s, t);
printf ("\n :: Menu :: \n1 try
        another infix expression.\n2.
        Exit \n Enter your choice : ");
scanf ("%d", &choice);
} while (choice != 2);
return 0;
}
```

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


            int stack[N];


            int top = -1;


            void push(int item){
                if(top==N-1)
                    printf("Stack overflow!\n");
                else
                    stack[++top] = item;
            }


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

            }


            int priority(char op){
                switch(op){
                    case '*':   return 2;
                                break;
                    case '/':   return 2;
                                break;
                    case '+':   return 1;
                                break;
```

```
        case '-':   return 1;
                    break;
        case '(':   return 0;
                    break;
    }
}


int main()
{
    char s[50];
    char t[50];
    int l;
    int choice = 1;

    do{
        l = 0;
        printf("Enter your infix expression: ");
        scanf("%s", s);

        for(int i=0; s[i]!='\0'; i++){
            switch(s[i]){
                case '(':   push('(');
                            break;
                case ')':   while(stack[top]!='('){
                                t[l++] = pop();
                            }
                            pop();
                            break;
                case '*':
                case '/':
                case '+':
                case '-':   while(top!=-1 &&
priority(stack[top])>=priority(s[i])){
                                t[l++] = pop();
                            }
```

```
                        push(s[i]);
                        break;
                default: t[l++] = s[i];
            }
        }

        while(top!=-1){
            t[l++] = pop();
        }

        t[l] = '\0';

        printf("Postfix expression for \"%s\" is \"%s\".\n", s, t);

        printf("\n     :: Menu ::     \n1. Try another infix expression.\n2.
Exit\nEnter your choice: ");


        scanf("%d", &choice);
    }while(choice!=2);

    return 0;
}
```

OUTPUT:

```
Enter your infix expression: vv
Postfix expression for "vv" is "vv".

    :: Menu ::
1. Try another infix expression.
2. Exit
Enter your choice: 1
Enter your infix expression: A+B
Postfix expression for "A+B" is "AB+".

    :: Menu ::
1. Try another infix expression.
2. Exit
Enter your choice: 1
Enter your infix expression: A+(B-c)
Postfix expression for "A+(B-c)" is "ABc-+".

    :: Menu ::
1. Try another infix expression.
2. Exit
Enter your choice: 1
Enter your infix expression: (A+(B-C)*D)
Postfix expression for "(A+(B-C)*D)" is "ABC-D*+".

    :: Menu ::
1. Try another infix expression.
2. Exit
Enter your choice: 2
```

3: WAP to simulate the working of a queue of integers using an array. Provide the following

operations

a) Insert b) Delete c) Display

The program should print appropriate messages for queue empty and queue overflow

Date / /
Page
SPLASH

Queue

```
# include <stdio.h>
# include <stdlib.h>
# define Que_size 3.
int item, front=0, rear=-1, q[Que_size];
void insert rear()
{ if( rear = Que_SIZE -1)
  {
     printf("Queue Overflow\n");
     return;
  }
rear = rear+1;
q[rear] = item;
} int deletefront()
{ if ( front > rear)
{ front = 0;
rear = -1
return -1;
} return q[ front++];
} void display Q()
{ int i;
if ( front > rear)
{
    printf ("Queue is empty\n");
    return;
}
  printf ("Contents of queue\n");
  for( i = front; i < rear; i++)
  {
      printf ("%d\n", q[i]);
} }
```

```
int main()
{
    int choice;
    for(;;)
    {
        printf("1) Insert rear\n 2) Delete front
                \n 3) Display \n 4) Exit\n");
        printf("Enter your choice:");
        scanf("%d", &choice);
        switch(choice)
        {
            case 1: printf("Enter the item
                        to be inserted\n");
            scanf("%d", &item);
            insert rear();
            break;
            case 2: item = deletefront();
            if(item == -1)
            printf("Queue is empty\n");
            else
            printf("Item deleted = %d\n",
                                item);
            break;
            case 3: displayQ();
            break;
            default: exit(0);
        }
    }
}
```

```
#include<stdio.h>
                    #include<stdlib.h>
                    #define QUE_SIZE 3
                    int item,front=0,rear=-1,q[10];
                    void insertrear()
                    {if(rear==QUE_SIZE-1)
                    {
                           printf("Queue Overflow\n");
                           return;
                    }
                    rear=rear+1;
                    q[rear]=item;
                    }int deletefront()
                    {if (front>rear)
                    {front=0;
                    rear=-1;
                    return -1;
                    }return q[front++];
                    }void displayQ()
                    {int i;
                    if (front>rear)
                    {
                           printf("Queue is empty\n");
                           return;
                    }
                    printf("contents of queue\n");
                    for(i=front;i<=rear;i++)
                    {
                           printf("%d\n",q[i]);
                    }}
                    int main()
                    {
                           int choice;
                           for(;;)
                           {
```

```
                printf("1)Insert rear\n2)Delete
front\n3)Display\n4)Exit\n");
                printf("Enter your choice: ");
                scanf("%d",&choice);
                switch(choice)
                {
                        case 1:printf("Enter the item to be inserted\n");
                        scanf("%d",&item);
                        insertrear ();
                        break;
                        case 2:item=deletefront();
                        if(item==-1)
                        printf("Queue is empty\n");
                        else
                        printf("Item deleted=%d\n",item);
                        break;
                        case 3:displayQ();
                        break;
                        default:exit (0);

                }

        }
        }
```

OUTPUT:

```
PS C:\Users\It's mine!\Desktop\C C++> cd "c:\Users\It's mine!\Desktop\C C++\.vscode\" ; if ($?) { gcc sss.c -o sss } ; if ($?)
 { .\sss }
1)Insert rear
2)Delete front
3)Display
4)Exit
Enter your choice: 1
Enter the item to be inserted
68
1)Insert rear
2)Delete front
3)Display
4)Exit
Enter your choice: 1
Enter the item to be inserted
67
1)Insert rear
2)Delete front
3)Display
4)Exit
Enter your choice: 2
Item deleted=68
1)Insert rear
2)Delete front
3)Display
4)Exit
Enter your choice: 3
contents of queue
67
1)Insert rear
2)Delete front
3)Display
4)Exit
Enter your choice: 4
PS C:\Users\It's mine!\Desktop\C C++\.vscode>
```

4: WAP to simulate the working of a circular queue of integers using an array. Provide the

following operations.

a) Insert b) Delete c) Display

The program should print appropriate messages for queue empty and queue overflow

Date / /
Page
SPLASH

Circular queue.

```
#include <stdio.h>
#include <stdlib.h>
#include <process.h>
#define que_size 3
int item, front = 0, rear = -1, q[que_size],
count = 0;
void insertrear()
{
    if (count == que_size)
    {
        printf("Queue overflow");
        return;
    }
    rear = (rear + 1) % que_size;
    q[rear] = item;
    count++;
}
int deletefront()
{
    if (count == 0) return -1;
    item = q[front];
    front = (front + 1) % que_size;
    count = count - 1;
    return item;
}
void displayq()
{
    int i, f;
    if (count == 0)
    {
```

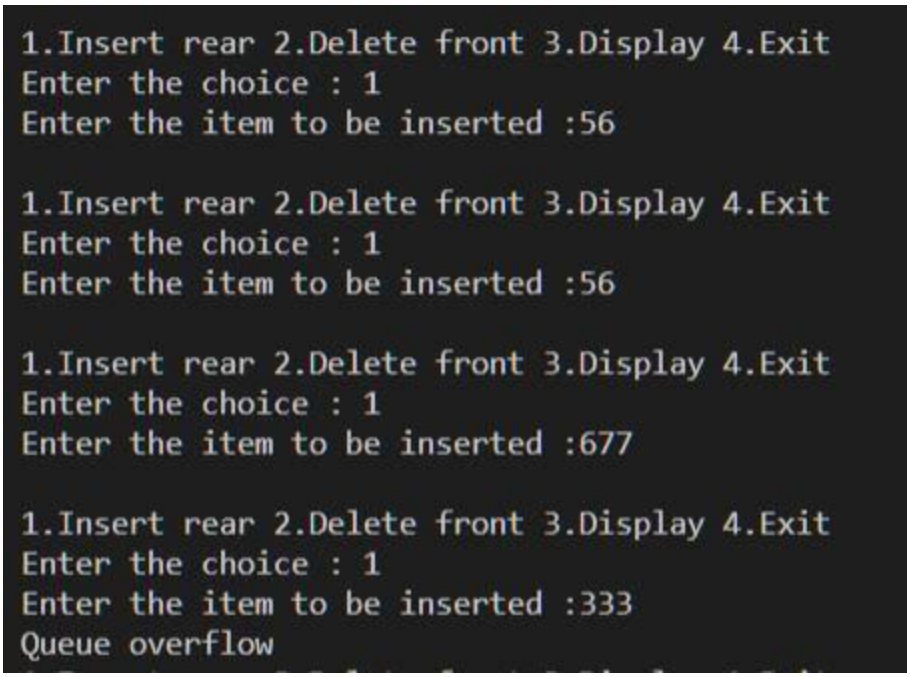
```
        printf("Queue is empty");
        return;
    }
    f = front;
    printf("Contents of queue \n");
    for( i=0; i<=count; i++)
    {
        printf("%d \n", q[f]);
        f = (f+1) % que_size;
    }
}
void main()
{
    int choice;
    for(;;)
    {
        printf("\n1.Insert rear \n2.Delete from
                \n3.display \n4.Exit \n");
        printf("Enter the choice: ");
        scanf("%d", &choice);
        switch(choice)
        {
            case1: printf("Enter the item to
                        be inserted: ");
                scanf("%d", &item);
                insert rear();
                break;
            case2: item=deletefront();
                if(item==-1)
                printf("Queue is empty\n");
                else
                printf("Item deleted is :%d\n
```

```
        break;
    case 3: displayq();
            break;
    default: exit(0);
    }
}
}
```

```
#include<stdio.h>
                    #include<stdlib.h>
                    #include<process.h>
                    #define que_size 3
                    int item,front=0,rear=-1,q[que_size],count=0;
                    void insertrear()
                    {
                            if(count==que_size)
                            {
                                    printf("Queue overflow");
                                    return;
                            }
                            rear=(rear+1)%que_size;
                            q[rear]=item;
                            count++;
                    }
                    int deletefront()
                    {
                            if(count==0) return -1;
                            item = q[front];
                            front=(front+1)%que_size;
                            count=count-1;
                            return item;
                    }
                    void displayq()
                    {
                            int i,f;
                            if(count==0)
                            {
                                    printf("Queue is empty");
                                    return;
                            }
                            f=front;
                            printf("Contents of queue \n");
                            for(i=0;i<=count;i++)
                            {
```

```
                printf("%d\n",q[f]);
                f=(f+1)%que_size;
        }
}
void main()
{
        int choice;
        for(;;)
        {
                printf("\n1.Insert rear 2.Delete front 3.Display 4.Exit
\n");
                printf("Enter the choice : ");
                scanf("%d",&choice);
                switch(choice)
                {
                        case 1:printf("Enter the item to be inserted :");
                               scanf("%d",&item);
                               insertrear();
                               break;
                        case 2:item=deletefront();
                                  if(item==-1)
                                  printf("Queue is empty\n");
                                  else
                                  printf("Item deleted is %d \n",item);
                                  break;
                    case 3:displayq();
                                  break;
                    default:exit(0);
                }
        }
}
```

OUTPUT:



5: 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. c) Display the contents of the linked list.

6: 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.

7: WAP Implement Single Link List with following operationsa) Sort the linked list. b) Reverse the linked list. c) Concatenation of two linked lists

Date __/__/__
Page _____
SPLASH

Singly linked list

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

Struct node
 {
   int info;
    struct node * link;
 };
typedef struct node *NODE;
NODE getnode()
 {
 NODE x;
 x = (NODE) malloc (sizeof (struct node));
 if (x = NULL)
  {
  printf ("mem full\n");
  exit 0;
 }
 return x;
}
Void freenode (NODE x)
{
  free (x);
}
NODE insert-front (NODE first, int item)
{
  NODE temp;
  temp = getnode();
  temp -> info = item;
  temp -> link = NULL;
```

```
if (first == NULL)
return temp;
temp -> link = first;
first = temp;
return first;
}
NODE If (NODE second, int item)
{
NODE temp;
temp = getnode();
temp -> info = item;
temp -> link = NULL;
if (second = NULL)
return temp;
temp -> link = second;
second = temp;
return second;
}
NODE temp;
if (first == NULL)
{
printf("list is empty cannot delete\n");
return first;
}
temp = first;
temp = temp -> link;
printf("item deleted at front-end
        is %d \n", first -> info);
free (first)
return temp;
}
NODE insert_rear (NODE first, int item)
```

```
{
NODE temp, cur;
temp = getnode();
temp -> info = item;
temp -> link = NULL;
if (first == NULL)
  return temp;
cur = first;
while (cur -> link != NULL)
     cur = cur -> link;
     cur -> link = temp;
     return first;
}
NODE IR (NODE second, int item)
 {
NODE temp, cur;
temp = get node();
temp -> info = item;
temp -> link = NULL;
if (second = NULL)
   return temp;
  cur = second;
while (cur -> link != NULL)
     cur = cur -> link;
     cur -> link = temp;
     return second;
}
NODE delete_rear (NODE first)
 {
 NODE cur, prev;
 if (first == NULL)
 {
```

```
printf("list is empty cannot delete\n");
return first;
}
if (first -> link == NULL)
{
printf("item deleted is %d\n",
                        first->info);
free (first);
return NULL;
}
prev = NULL;
cur = first;
while (cur -> link != NULL)
{
prev = cur;
cur = cur -> link;
}
printf("item deleted at rear-end
        is %d", cur -> info);
free (cur);
prev -> link = NULL;
return first;
}
NODE insert_pos(int item, int pos,
                        NODE first)
{
NODE temp;
NODE prev, cur;
int count;
temp = getnode();
temp -> info = item;
temp -> link = NULL;
```

```
if (first == NULL && pos == 1)
  return temp;
if (first == NULL)
{
printf ("invalid pos \n");
  return first;
}
if (pos == 1)
{
temp -> link = first;
return temp;
}
count = 1;
prev = NULL;
cur = first;
while (cur != NULL && count != pos)
{
 prev = cur;
  cur = cur -> link;
  count ++;
}
if (count == pos)
{
prev -> link = temp;
temp -> link = cur;
return first;
}
printf ("Invalid position \n");
return first;
}
NODE delete_pos(int pos, NODE first)
{
```

```
NODE cur;
NODE prev;
int count;
if ( first == NULL || pos <= 0)
{
printf ("Invalid position\n");
return NULL;
}
if (pos == 1)
{
cur = first;
first = first -> link;
freenode (cur);
return first;
}
prev = NULL;
cur = first;
count = 1;
while (cur != NULL)
{
if ( count == pos)
break;
prev = cur;
cur = cur -> link;
count++;
}
if (count != pos)
{
  printf ("Invalid position\n");
  return first;
}
if ( count != pos)
```

```
{
printf("Invalid position specified\n");
  return first;
}
prev -> link = cur -> link;
  freenode(cur);
return first;
}
NODE reverse(NODE first)
    {
        NODE cur, temp;
        cur = NULL;
        while(first != NULL)
          {
            temp = first;
            first = first -> link;
            temp -> link = cur;
            cur = temp;
        }
    return cur;
}
NODE asc(NODE first)
{
  NODE prev = first;
  NODE cur = NULL;
            int temp;
if(first == NULL) {
          return 0;
        }
else {
    while(prev != NULL) {
      cur = prev -> link;
```

```
while(cur1 = NULL) {
if (prev -> info > cur -> info) {
    temp = prev -> info;
    prev -> info = cur -> info;
    cur -> info = temp;
    }
    cur = cur -> link;
    }
    prev = prev -> link;
    }
    return first;
}
NODE des (NODE first)
{
  NODE prev = first;
  NODE cur = NULL;
        int temp;
if ( first == NULL) {
        return 0;
    }
    else {
    while (prev1 = NULL) {
    cur = prev -> link;
    while (cur1 = NULL) {
    if (prev -> info < cur->info) {
    temp = prev -> info;
    prev -> info = cur -> info;
    cur -> info = temp;
    }
    cur = cur -> link;
    }
```

```
        prev = prev -> link;
      }
    }
    return first;
  }
NODE concat(NODE first, NODE second)
{
  NODE cur;
  if (first == NULL)
  return second;
  if (second == NULL)
  return first;
  cur = first;
  while (cur -> link != NULL)
  {
    cur = cur -> link;
  }
  cur -> link = second;
  return first;
}

void display (NODE first)
{
NODE temp;
if (first == NULL)
printf ("list empty cannot display
                        item \n");
for (temp = first ; temp != NULL; temp =
                        temp -> link)
{
  printf ("%d \n", temp -> info);
}
```

```
};
int main()
{
int item, choice, pos, element, option,
        choice2, item1, num;
NODE first = NULL;
NODE second = NULL;

for (;;)
{
 printf("\n1: Insert - front
         \n2: Delete front
         \n3: Insert front
         \n4: Delete front
         \n5: random position
         \n6: reverse
         \n7: sort
         \n8: concat
         \n9. display - list
         \n10. Exit \n");
printf("Enter the choice\n");
scanf("%d", &choice\n");
scanf switch(choice)
   {
    case1: printf("Enter the item at
                    front-end\n");
           scanf("%d", &item);
           first= insert_front(first,
                               item);
           break;
    case2: first = delete_front(first);
           break;
```

```
case 3: printf("Enter the item at rear-
                                ent \n");
        scanf("%d", &item);
        first = insert_rear(first, item);
        break;
case 4: first = delete_rear(first);
        break;
case 5:
printf("press 1 to insert or 2 to delete at
        any desired position \n");
scanf("%d", &element);
if(element == 1){
        printf("Enter the position to
                insert \n");
        scanf("%d", &pos);
        printf("Enter the item to insert
                \n");
        scanf("%d", &item);
        first = insert_pos(item, pos, first);
}
if(element == 2){
        printf("Enter the position to delete
                \n");
        scanf("%d", &pos);
        first = delete_pos(pos, first);
}
        break;
case 6:
        first = reverse(first);
        break;
case 7:
        printf("press 1 for ascending sort
```

```
and 2 for descending sort :\n");
scanf("%d", &option);
if(option == 1)
first = asc(first);
if(option == 2)
first = des(first);
break;
case 8:
        printf("Create a second list \n");
        printf("Enter the number of
                elements in second
                list \n");
        scanf("%d", &num);
        for(int i=1; i<=num; i++){
printf("\n press 1 to insert
                front and 2 to insert
                rear \n");
        scanf("%d", &choice2);

        if(choice2==1){
          printf("Enter the item at
                front-end \n");
          scanf("%d", &item1);
        Second = IF(Second, item1);
        }
if(choice2==2){
printf("Enter the item at rear end\n");
    scanf("%d", &item1);
    Second = IR(Second, item1);
}
}
```

```
        first = concate (first, second);
        break;
    case 9: display (first);
            break;
    default : exit(0);
            break;
    }
}
return 0;
}
```

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


                    struct node
                    {
                      int info;
                      struct node *link;
                    };
                    typedef struct node *NODE;
                    NODE getnode()
                    {
                    NODE x;
                    x=(NODE)malloc(sizeof(struct node));
                    if(x==NULL)
                     {
                      printf("mem full\n");
                      exit(0);
                     }
                     return x;
                    }
                    void freenode(NODE x)
                    {
                    free(x);
                    }
                    NODE insert_front(NODE first,int item)
                    {
                    NODE temp;
                    temp=getnode();
                    temp->info=item;
                    temp->link=NULL;
                    if(first==NULL)
                    return temp;
                    temp->link=first;
                    first=temp;
                    return first;
```

```
}
NODE IF(NODE second,int item)
{
NODE temp;
temp=getnode();
temp->info=item;
temp->link=NULL;
if(second==NULL)
return temp;
temp->link=second;
second=temp;
return second;
}
NODE delete_front(NODE first)
{
NODE temp;
if(first==NULL)
{
printf("list is empty cannot delete\n");
return first;
}
temp=first;
temp=temp->link;
printf("item deleted at front-end is=%d\n",first->info);
free(first);
return temp;
}
NODE insert_rear(NODE first,int item)
{
NODE temp,cur;
temp=getnode();
temp->info=item;
temp->link=NULL;
if(first==NULL)
 return temp;
cur=first;
```

```
while(cur->link!=NULL)
 cur=cur->link;
cur->link=temp;
return first;
}
NODE IR(NODE second,int item)
{
NODE temp,cur;
temp=getnode();
temp->info=item;
temp->link=NULL;
if(second==NULL)
 return temp;
cur=second;
while(cur->link!=NULL)
 cur=cur->link;
cur->link=temp;
return second;
}
NODE delete_rear(NODE first)
{
NODE cur,prev;
if(first==NULL)
{
printf("list is empty cannot delete\n");
return first;
}
if(first->link==NULL)
{
printf("item deleted is %d\n",first->info);
free(first);
return NULL;
}
prev=NULL;
cur=first;
while(cur->link!=NULL)
```

```
{
prev=cur;
cur=cur->link;
}
printf("iten deleted at rear-end is %d",cur->info);
free(cur);
prev->link=NULL;
return first;
}
NODE insert_pos(int item,int pos,NODE first)
{
NODE temp;
NODE prev,cur;
int count;
temp=getnode();
temp->info=item;
temp->link=NULL;
if(first==NULL && pos==1)
return temp;
if(first==NULL)
{
 printf("invalid pos\n");
 return first;
}
if(pos==1)
{
temp->link=first;
return temp;
}
count=1;
prev=NULL;
cur=first;
while(cur!=NULL && count!=pos)
{
 prev=cur;
 cur=cur->link;
```

```
 count++;
}
if(count==pos)
{
prev->link=temp;
temp->link=cur;
return first;
}
printf("Invalid Position \n");
return first;
}
NODE delete_pos(int pos, NODE first)
{
NODE cur;
NODE prev;
int count;
if(first==NULL || pos<=0)
{
printf("invalid position \n");
return NULL;
}
if (pos==1)
{
cur=first;
 first=first->link;
freenode(cur);
return first;
}
prev=NULL;
cur=first;
count=1;
while(cur!=NULL)
{
if(count==pos)
break;  //if found
prev=cur;
```

```
cur=cur->link;
count++;
}
if(count!=pos)
{
  printf("invalid position\n");
   return first;
}
if(count!=pos)
{
  printf("invalid position specified\n");
  return first;
}

prev->link=cur->link;
 freenode(cur);
return first;
}
NODE reverse(NODE first)
  {
    NODE cur,temp;
    cur=NULL;
    while(first!=NULL)
    {
        temp=first;
        first=first->link;
        temp->link=cur;
        cur=temp;
    }
    return cur;
}
NODE asc(NODE first)
{
    NODE prev=first;
    NODE cur=NULL;
                int temp;
```

```
if(first== NULL) {
          return 0;
          }
else {
         while(prev!= NULL) {

          cur = prev->link;

          while(cur!= NULL) {

        if(prev->info > cur->info) {
          temp = prev->info;
          prev->info = cur->info;
          cur->info = temp;
           }
           cur = cur->link;
          }
          prev= prev->link;
                    }
               }
               return first;
           }
NODE des(NODE first)
{
    NODE prev=first;
    NODE cur=NULL;
                int temp;

if(first==NULL) {
       return 0;
        }
       else {
         while(prev!= NULL) {

         cur = prev->link;
```

```
          while(cur!= NULL) {

        if(prev->info < cur->info) {
          temp = prev->info;
          prev->info = cur->info;
          cur->info = temp;
              }
              cur = cur->link;
              }
              prev= prev->link;
               }
               }
               return first;
           }
NODE concate(NODE first,NODE second)
{
    NODE cur;
    if(first==NULL)
    return second;
    if(second==NULL)
    return first;
    cur=first;
    while(cur->link!=NULL)
    {
        cur=cur->link;

    }
    cur->link=second;
    return first;
}


void display(NODE first)
{
 NODE temp;
```

```
 if(first==NULL)
 printf("list empty cannot display items\n");
 for(temp=first;temp!=NULL;temp=temp->link)
  {
  printf("%d\n",temp->info);
  }
}
int main()
{
int item,choice,pos,element,option,choice2,item1,num;
NODE first=NULL;
NODE second=NULL;


for(;;)
{
printf("\n 1:Insert_front\n 2:Delete_front\n 3:Insert_rear\n
4:Delete_rear\n 5:random_position\n 6:reverse\n 7:sort\n 8.concate\n
9:display_list\n 10:Exit\n");
printf("enter the choice\n");
scanf("%d",&choice);
switch(choice)
 {
  case 1:printf("enter the item at front-end\n");
         scanf("%d",&item);
         first=insert_front(first,item);
         break;
  case 2:first=delete_front(first);
         break;
  case 3:printf("enter the item at rear-end\n");
         scanf("%d",&item);
         first=insert_rear(first,item);
         break;
  case 4:first=delete_rear(first);
         break;
 case 5:
```

```
printf("press 1 to insert or 2 to delete at any desired position \n");
scanf("%d",&element);
if(element==1){
        printf("enter the position to insert \n");
               scanf("%d",&pos);
               printf("enter the item to insert \n");
               scanf("%d",&item);
               first=insert_pos(item,pos,first);
}
if(element==2){
        printf("enter the position to delete \n");
               scanf("%d",&pos);
               first=delete_pos(pos,first);
}
               break;
 case 6:
       first=reverse(first);
       break;
 case 7:
       printf("press 1 for ascending sort and 2 for descending sort:\n");
       scanf("%d",&option);
       if(option==1)
       first=asc(first);
       if(option==2)
       first=des(first);
       break;
 case 8:
       printf("create a second list\n");
       printf("enter the number of elements in second list\n");

       scanf("%d",&num);
        for(int i=1;i<=num;i++){
       printf("\n press 1 to insert front and 2 to insert rear \n");
       scanf("%d",&choice2);

           if(choice2==1){
```

```
                printf("enter the item at front-end\n");
                    scanf("%d",&item1);
                second=IF(second,item1);
                 }

                if(choice2==2){
                printf("enter the item at rear-end\n");
                   scanf("%d",&item1);
                second=IR(second,item1);
                }
              }

             first=concate(first,second);
             break;

  case 9:display(first);
         break;
 default:exit(0);
         break;
 }
}
return 0;
}
```

OUTPUT:

```
 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
1
enter the item at front-end
34

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
1
enter the item at front-end
45

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
1
enter the item at front-end
56

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
1
enter the item at front-end
67
```

```
 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
1
enter the item at front-end
85

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
9
85
67
56
45
34

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
7
press 1 for ascending sort and 2 for descending sort:
1

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
9
34
45
56
67
85
```

```
 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
5
press 1 to insert or 2 to delete at any desired position
2
enter the position to delete
5

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
6

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
9
67
56
45
34

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
8
create a second list
enter the number of elements in second list
4

 press 1 to insert front and 2 to insert rear
1
enter the item at front-end
2

 press 1 to insert front and 2 to insert rear
1
enter the item at front-end
3
```

```
 press 1 to insert front and 2 to insert rear
1
enter the item at front-end
5

 press 1 to insert front and 2 to insert rear
2
enter the item at rear-end
4

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
9
67
56
45
34
5
3
2
4

 1:Insert_front
 2:Delete_front
 3:Insert_rear
 4:Delete_rear
 5:random_position
 6:reverse
 7:sort
 8.concate
 9:display_list
 10:Exit
enter the choice
10
PS C:\Users\It's mine!\Desktop\C C++\.vscode>
```

8: WAP to implement Stack & Queues using Linked Representation

Date __/__/__
Page _____
SPLASH

Stack and Queues using Linked representation.

```
#include <stdio.h>
#include <math.h>
#include <stdlib.h>
#include <string.h>
Struct node
{
  int item;
  Struct node *next;
};
typedef struct node * NODE; Node;
Node getNode()
 {
   Node x;
   x = (Node) malloc (sizeof (Struct node));
   return x;
}
Node insert_front (Node first, int data)
{
  Node new_node;
  new_node = getNode();
  new_node -> item = data;
  new_node -> next = NULL;
  if (first = NULL)
  {
    return new_node;
  }
  new_node -> next = first;
  first = new_node;
  return first;
```

```
}
Node insert_end(Node first, int data)
{
 Node last;
 Node new_node;
 new_node = getNode();
 new_node -> item = data;
 new_node -> next = NULL;
 if ( first = NULL)
 {
  return new node;
 }
 last = first;
 while (last -> next != NULL)
 {
   last = last -> next;
 }
 last -> next = new node;
 return first;
}
Node delete_front (Node first)
{
   Node temp;
   if ( first == NULL)
   {
    printf ("List is empty cannot be
              deleted \n");
    return first;
   }
   temp = first;
   temp = temp -> next;
   free (first);
```

```
return temp;
}
Node delete_end (Node first)
{
  Node prev, cur;
  if (first == NULL)
  {
  printf ("List is empty and cannot be
          deleted \n"); return first;
  }
  cur = first;
  while (cur -> next != NULL)
  {
    prev = cur;
    cur = cur -> next;
  }
  prev -> next = NULL;
  free (cur);
  return first;
}
void display (Node first)
{
  Node temp;
  if (first == NULL)
  {
    printf ("List is empty \n");
  }
  for (temp = first; temp != NULL;
       temp = temp -> next)
  {
    printf ("%d \n", temp -> item);
  }
}
```

```
void stack()
{

void stack()
{
 int choice, data;
 Node head = NULL;
printf("Stack is implemented insertion
        rear and delete rear\n");

do {
   printf("1. insert rear\n");
   printf("2. delete rear\n");
   printf("3. Display\n");
   printf("4. Exit\n");
   printf("Enter your choice\n");
   Scanf("%d", &choice);
   Switch(choice)
   {
case 1:
 printf("Enter the Data to be inserted
        \n");
Scanf("%d", &data);
head = insert_end(head, data);
break;
case 2:
 head = delete_end(head);
 break;
case 2:
head = delete_end(head);
break;
printf("Enter the data to be
                inserted\n");
```

```
scanf("%d", &data);
head = insert_end(head, data);
break;
case 2:
head = delete_end(head);
break;
case 3:
display(head);
break;
}

} while(choice != 4);
}

void q()
{
int choice, data;
Node head = NULL;
printf("Queue is implemented
        insert front and delete
        front \n");
do {
printf("1: Insert front \n");
printf("2. Delete front \n");
printf("3. Display \n");
printf("4: Exit \n");
printf("Enter your choice \n");
scanf("%d", &choice);
switch(choice)
{
case 1:
  printf("Enter the data to be
          inserted \n");
```

```
Scanf ("%d", &data);
head = insert_front (head, data);
break;
case 2:
head = delete_front (head);
break;
case 3:
display (head);
break;
}
} while (choice != 4);
}
int main()
{
int option;
printf ("1: Stack \n");
printf ("2: Queue \n");
printf ("3: Exit \n");
printf ("Enter your choice \n");
Scanf ("%d", &option);
Switch (option)
{
case 1:
stack();
break;
case 2:
q();
break;
case 3:
exit (0)
break;
}
}
```

```
#include<stdio.h>
#include<math.h>
#include<stdlib.h>
#include<string.h>
struct node
{
int item;
struct node *next;
};
typedef struct node *Node;
Node getNode()
{
Node x;
x=(Node)malloc(sizeof(struct node));
return x;
}
Node insert_front(Node first,int data)
{
Node new_node;
new_node=getNode();
```

```
new_node->item=data;
new_node->next=NULL;
if(first==NULL)
{
return new_node;
}
new_node->next=first;
first=new_node;

return first;
}
Node insert_end(Node first,int data)
{
Node last;
Node new_node;
new_node=getNode();
new_node->item=data;
new_node->next=NULL;
if(first==NULL)
{
```

```
return new_node;
}
last=first;
while(last->next!=NULL)
{
last=last->next;
}
last->next=new_node;
return first;
}
Node delete_front(Node first)
{
Node temp;

if(first==NULL)
{
printf("List Is Empty Cannot be deleted\n"); return first;
}
temp=first;
temp=temp->next;
```

```
free(first);
return temp;
}
Node delete_end(Node first)
{
Node prev,cur;
if(first==NULL)
{
printf("List Is Empty And Cannot be deleted\n"); return first;
}
cur=first;
while(cur->next!=NULL)
{
prev=cur;
cur=cur->next;
}
prev->next=NULL;
free(cur);
return first;
}
```

```
void display(Node first)
{
Node temp;
if(first==NULL)
{
printf("List Is Empty\n");
}
for(temp=first;temp!=NULL;temp=temp->next)
{
printf("%d\n",temp->item);
}
}
void stack()
{
int choice,data;
Node head=NULL;
printf("STACK IS IMPLEMENTED INSERT REARE AND DELETE
REAR\n");
do{
printf("1:INSERT REAR\n");
```

```
printf("2:DELETE REAR\n");
printf("3:DISPLAY\n");
printf("4:EXIT\n");
printf("Enter Your Choice\n");
scanf("%d",&choice);
switch(choice)
{


case 1:printf("Enter The Data To Be Inserted\n");
scanf("%d",&data);
head=insert_end(head,data);
break;
case 2:
head=delete_end(head);
break;
case 3:
display(head);
break;
}
```

```
}while(choice!=4);
}
void q()
{
int choice,data;
Node head=NULL;
printf("QUEUE IS IMPLEMENTED INSERT FRONT AND DELETE FRONT\n");
do{
printf("1:INSERT FRONT\n");
printf("2:DELETE FRONT\n");
printf("3:DISPLAY\n");
printf("4:EXIT\n");
printf("Enter Your Choice\n");
scanf("%d",&choice);
switch(choice)
{
case 1:
printf("Enter The Data To Be Inserted\n");
scanf("%d",&data);
```

```
head=insert_front(head,data);
break;
case 2:
head=delete_front(head);
break;
case 3:
display(head);
break;
}

}while(choice!=4);
}
int main()
{
int option;
printf("1:STACK\n");
printf("2:QUEUE\n");
printf("3:EXIT\n");
printf("Enter Your Choice\n");
scanf("%d",&option);
```

```
switch(option)
{
case 1:
stack();
break;
case 2:
q();
break;
case 3:
exit(0);
break;
}

}
```

OUTPUT:

```
PS C:\Users\It's mine!\Desktop\C C++> cd "c:\Users\It's mine!\Desktop\C C++\.vscode\" ; if ($?) { gcc sss.c -o sss } ; if ($?) { .\sss }
1:STACK
2:QUEUE
3:EXIT
Enter Your Choice
1
STACK IS IMPLEMENTED INSERT REARE AND DELETE REAR
1:INSERT REAR
2:DELETE REAR
3:DISPLAY
4:EXIT
Enter Your Choice
1
Enter The Data To Be Inserted
56
1:INSERT REAR
2:DELETE REAR
3:DISPLAY
4:EXIT
Enter Your Choice
1
Enter The Data To Be Inserted
78
1:INSERT REAR
2:DELETE REAR
3:DISPLAY
4:EXIT
Enter Your Choice
1
Enter The Data To Be Inserted
78
1:INSERT REAR
2:DELETE REAR
3:DISPLAY
4:EXIT
Enter Your Choice
2
1:INSERT REAR
2:DELETE REAR
3:DISPLAY
4:EXIT
Enter Your Choice
3
56
78
1:INSERT REAR
2:DELETE REAR
3:DISPLAY
4:EXIT
Enter Your Choice
4
PS C:\Users\It's mine!\Desktop\C C++\.vscode>
```

9: WAP 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

Date __/__/__
Page _____
SPLASH

Lab-8

```
#include <stdio.h>
#include <string.h>
#include <math.h>
#include <malloc.h>
#include <stdlib.h>
Struct node
{
   int item;
   struct node *next;
};
typedef struct node * Node;

Node getNode()
{
   Node x;
      x = (Node) malloc (sizeof( struct node));
      return x;
}
Node insert_front (Node first, int data)
{
   Node new_node;
   new_node = getNode();
   new_node -> item = data;
   new_node -> next = NULL;
   if (first == NULL)
   {
      return new_node;
   }
```

```
    new_node -> next = first;
    first = new_node;
    return first;
}
Node delete_end(Node first)
{
    Node prev, cur;
    if (first == NULL)
    {
        printf("List is Empty and
                cannot be deleted\n");
        return first;
    }
    cur = first;
    while (cur -> next != NULL)
    {
        prev = cur;
        cur = cur -> next;
    }
    prev -> next = NULL;
    free (cur);
    return first;
}
void display (Node first)
{
    int count=0;
    Node temp;
    if (first == NULL)
    {
        printf("\n List is Empty\n");
    }
    for (temp = first; temp != NULL; temp
                                = temp -> next)
```

```
{
    count++;
    printf("%d\n", temp->item);
}
printf("\n Number of Nodes
        in the list are
        %d\n", count);
}
void search(Node first, int data)
{
    int pos=0
    Node temp;
    int i;
    if(first == NULL)
    {
    printf("List is empty\n");
    return;
    }
  for(temp=first, i=0; temp!=NULL;
      temp=temp->next, i++)
  {
    if(temp->item == data)
    {
      pos=i+1;
      printf("\n Search Successfull\n");
      printf("Element is found at
              position %d\n", pos);
      break;
    }
    else
    {
      pos=0;
```

```
    }
}
if( pos==0)
{
    printf("\n Search Unsuccessfull \n");
}
}
void sort(Node first)
{
    int t;
    Node temp;
    if( first == NULL)
    {
        printf("List is Empty \n");
        return;
    }
    for(Node i = first; i != NULL; i=i
                                -> Next)
    {
        for( Node j = i -> next; j != Null; j=j
                                -> Next)
        {
            if((i -> item) > (j -> item))
            {
                t = i -> item;
                i -> item = j -> itm;
                j -> item = t;
            }
        }
    }
    printf("\n List in ascending orde
                r is \n");
```

```
}
int main()
{
  Node first = NULL;
  Node a = NULL;
  Node b = NULL;
  Node ans = NULL;
  int choice, val, pos, n;
  do
  {
    printf("**** Actions ****\n");
    printf("1. Insert front\n");
    printf("2. Delete end\n");
    printf("3: Sort the list\n");
    printf("4. Search for an element\n");
    printf("5. Display the count
                and list\n");
    printf("\n Which action do yo
                wanna perform ?\n");
    scanf("%d", &choice);
    switch(choice)
    {
      case 1:
        printf("Enter the value to be
                inserted\n");
        scanf("%d", &val);
        first = insert_front(first, val);
        break;
      Case 2:
        first = delete_end(first);
        break;
```

```
case 3:
    sort (first)
    display (first);
    break;
case 4:
    printf ("Enter the number to
            searched \n");
    scanf ("%d", &n);
    Search (first, n);
    break;
case 5:
    printf ("\n The elements are. \n");
    display (first);
    break;
}
while (choice != 6);
}
```

OUTPUT:

```
PS C:\Users\It's mine!\Desktop\C C++> cd "c:\Users\It's mine!\Desktop
\C C++\.vscode\" ; if ($?) { gcc link2.c -o link2 } ; if ($?) { .\lin
k2 }
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
34
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
45
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
67
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
78
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
99
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
90
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
100
```

```
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
91
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
68
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
5

The Elements are:
68
91
100
90
99
78
67
45
34

Number of Nodes In The List Are 9
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
1
Enter the Value To Be Inserted
666
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit


Which action do you wanna perform?
4
Enter the Number To Searched
34

Search Successfull
Element Is Found At Position 10
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
2
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit
```

```
Which action do you wanna perform?
5

The Elements are:
666
68
91
100
90
99
78
67
45

Number of Nodes In The List Are 9
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
3

List In Ascending order is
45
67
68
78
90
91
99
100
666

Number of Nodes In The List Are 9
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
2
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
5

The Elements are:
45
67
68
78
90
91
99
100

Number of Nodes In The List Are 8
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit

Which action do you wanna perform?
4
Enter the Number To Searched
350

Search Unsuccesfull
****Actions****
1:Insert Front
2:Delete End
3:Sort the List
4:Search For an Element
5:Display the Count and list
6: Exit
```

10: 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.

Date / /
Page
SPLASH

Binary tree

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

Struct node
{
  int info;
  Struct node * r link;
  Struct node * l link;
};
typedef struct node * NODE;
NODE getnode()
{
  NODE x;
  x = (NODE) malloc( Sizeof (Struct node));
  if (x == NULL)
  {
   printf ("mem full \n");
    exit (0);
  }
 return x;
}
void freenode (NODE x)
{
   free(x);
}
NODE insert (NODE root, int item)
{
  NODE temp, cur, prev;
  temp = getnode ();
  temp -> r link = NULL;
```

```
temp -> llink = NULL;
temp -> info = item;
if (root == NULL)
return temp;
prev = NULL;
cur = root;
while (cur != NULL)
{
    prev = cur;
    cur = (item < cur -> info) ? cur
          -> llink : cur -> rlink;
}
if (item < prev -> info)
prev -> llink = temp;
else
prev -> rlink = temp;
return root;
}
void display (NODE root, int i)
{
int j;
if (root == NULL)
{
display (root -> rlink, i+1);
for (j=0; j<i; j++)
printf ("  ");
printf ("%d \n", root -> info);
display (root -> llink, i+1);
}
NODE delete (NODE root, int item)
{
NODE cur, parent, q, suc;
```

```
if (root == NULL)
{
    printf ("Empty tree");
    return root;
}
parent = NULL;
cur root;
while (cur != NULL && item != cur
        -> info)
{
    parent = cur;
    cur = ( item < cur -> info ) ? cur
        -> llink : cur -> rlink;
}
if (cur == NULL)
{
    printf ("not found\n");
    return root;
}
if (cur -> llink == NULL)
    q = cur -> rlink;
else if ( cur -> rlink == NULL)
    q = cur -> llink;
else
{
    suc = cur -> rlink;
    while (suc -> llink != NULL)
    suc = suc -> llink;
    suc -> llink = cur -> llink;
    q = cur -> rlink;
}
```

```
if( parent == NULL)
    return q;
if (cur == parent -> llink)
    parent -> llink = q;
else
   parent -> rlink = q;
   freenode (cur);
   return root;
}
void preorder (NODE root)
{
   if ( root != NULL)
   {
      printf ("%d\n", root -> info);
      preorder ( root -> llink );
      preorder ( root -> rlink);
   }
}
void postorder (NODE root)
{
  if (root != NULL)
  {
    postorder ( root -> llink)
    postorder (root -> rlink)
    printf ("%d\n", root -> info);
  }
}
void inorder (NODE root)
{
   if (root != NULL
```

```
        printf("%d\n", root->info);
        inorder(root->rlink);
    }
}
void main()
{
    int item, choice
    NODE root = NULL;
    for(;;)
    {
        printf("\n ---MENU---");
        printf("\n1. Insert 4. Post 2.
                . Display 5. In 3. Pre.
                6. Delete 7. Exit\n");
        printf("Enter your choice");
        switch(choice)
        {
        case1: printf("Enter the item\n");
               scanf("%d", &item);
               root = insert(root, item);
               break;
        case2: display(root, 0);
               break;
        case3: preorder(root);
               break;
        case4: postorder(root);
               break;
        case5: inorder(root);
               break;
        case6: printf("Enter the item\n");
               scanf("%d", &item);
               root = delete(root, item);
```

Date __/__/__
Page _____
SPLASH

```
        break;
    default : exit(0);
              break;
    }
}
}
```

```
#include<stdio.h>
#include<math.h>
#include<string.h>
#include<stdlib.h>
struct node
{
int data;
struct node *left;
struct node *right;
};
typedef struct node *NODE;
NODE getnode(int data)
{
NODE x=(NODE)malloc(sizeof(struct node));
x->data=data;
x->right=NULL;
x->left=NULL;
return x;
}
```

```
NODE insert(NODE root,int info)
{
if(root==NULL)
{
root=getnode(info);
return root;
}
else if(info<=root->data)
{
root->left=insert(root->left,info);
}
else
{
root->right=insert(root->right,info);
}
return root;
}
void preorder(NODE root)
```

```
{
if(root==NULL)
return;
printf("%d\t",root->data);
preorder(root->left);
preorder(root->right);
}
void inorder(NODE root)
{
if(root==NULL)
return;
inorder(root->left);
printf("%d\t",root->data);
inorder(root->right);
}
void postorder(NODE root)
{
if(root==NULL)
return;
```

```
postorder(root->left);
postorder(root->right);
printf("%d\t",root->data);
}
NODE findmin(NODE root)
{
if(root==NULL)
{
return NULL;
}
else if(root->left==NULL)
{
return root;
}
return findmin(root->left);
}
NODE findmax(NODE root)
{
if(root==NULL)
```

```
return NULL;
else if(root->right==NULL)
return root;
return findmax(root->right);
}
NODE delete_node(NODE root,int info)
{
if(root==NULL)
{
return root;
}
else if(info<root->data)
{
root->left=delete_node(root->left,info);
}
else if(info>root->data)
{
root->right=delete_node(root->right,info);
}
```

```
else
if(root->left==NULL&&root->right==NULL)
{
free(root);
root=NULL;
return root;
}
else if(root->left==NULL)
{
NODE temp=root;
root=root->left;
free(temp);
return root;
}
else if(root->right==NULL)
{
NODE temp=root;
root=root->right;
```

```
free(temp);
return root;

}
else
{
NODE temp=findmin(root->right);
root->data=temp->data;
root->right=delete_node(root->right,temp->data);
return root;
}
}
}

void display(NODE root,int i)
{
if(root==NULL)
return;
display(root->right,i+1);
```

```
for(int j=1;j<=i;j++)
printf(" ");
printf("%d\n",root->data);
display(root->left,i+1);

}

int getleafcount(NODE root)
{
NODE current=root;
if(current==NULL)
return 0;
else if(current->right==NULL&&current->left==NULL)
return 1;
else
return (getleafcount(current->left)+getleafcount(current->right));
}
int height(NODE root)
{
```

```
if(root==NULL)
return -1;
int left_height=height(root->left);
int right_height=height(root->right);
if(left_height>right_height)
return left_height+1;
else

return right_height+1;
}
NODE search(NODE root,int key)
{
if(root==NULL)
return NULL;
if(root->data==key)
return root;
else if(key<root->data)
search(root->left,key);
else if(key>root->data)
```

```
search(root->right,key);
else
printf("Search UnSuccessfull\n");
}
NODE inorder_successor(NODE root,int data)
{
if(root==NULL)
{

printf("Tree Empty\n");
return root;
}
NODE current=search(root,data);
//NODE current=root;
if(current==NULL)
return NULL;
if(current->right!=NULL)
{
NODE temp=findmin(current->right);
```

```
}
else
{
NODE successor=NULL;
NODE ancestor=root;
while(current!=ancestor)
{
if(current->data<ancestor->data)
{
successor=ancestor;
ancestor=ancestor->left;
}
else
{
ancestor=ancestor->right;
}
}
return successor;
}
```

```
}
int main()
{
NODE root=NULL;
NODE value=NULL;
int data,option,ans;
do{
printf("1:Insert\n");
printf("2:Delete\n");
printf("3:Preorder\n");
printf("4:PostOrder\n");
printf("5:Inorder\n");
printf("6:Display\n");
printf("7:Height Of Tree\n");
printf("8:Find Maximum\n");
printf("9:Search\n");
printf("10:In Order Successor\n");
printf("11:Exit\n");
printf("Enter Your Choice\n");
```

```
scanf("%d",&option);
switch(option)
{
case 1:
printf("Enter The Data To Be Inserted\n");
scanf("%d",&data);
root=insert(root,data);
break;
case 2:
printf("Enter the Data To Be Deleted\n");
scanf("%d",&data);
root=delete_node(root,data);
break;
case 3:
preorder(root);
printf("\n");
break;
case 4:
postorder(root);
```

```
printf("\n");
break;
case 5:
inorder(root);
printf("\n");
break;
case 6:
display(root,1);
break;
case 7:
ans=height(root);
printf("Height Of Tree Is %d\n",ans);
break;
case 8:
value=findmax(root);
printf("Maximum Value is%d\n",value->data); break;
case 9:
printf("Enter the Key Value To Be Searched\n");
scanf("%d",&data);
```

```
value=search(root,data);
if(root!=NULL)
printf("Search SuccessFull\n");
else
printf("Search Unsuccesfull\n");
break;
case 10:
printf("Enter the key value whose successor you want to find\n");
scanf("%d",&data);
root=inorder_successor(root,data);
printf("Successor is %d\n",root->data);
}
}while(option!=11);
}
```

OUTPUT:


1:Insert
2:Delete
3:Preorder
4:PostOrder
5:Inorder
6:Display
7:Height Of Tree
8:Find Maximum
9:Search
10:In Order Successor
11:Exit
Enter Your Choice
1
Enter The Data To Be Inserted
15
1:Insert
2:Delete
3:Preorder
4:PostOrder
5:Inorder
6:Display
7:Height Of Tree
8:Find Maximum
9:Search
10:In Order Successor
11:Exit
Enter Your Choice
1
Enter The Data To Be Inserted
10
1:Insert
2:Delete
3:Preorder
4:PostOrder
5:Inorder
6:Display
7:Height Of Tree
8:Find Maximum
9:Search
10:In Order Successor
11:Exit
Enter Your Choice
1
Enter The Data To Be Inserted
25
1:Insert
2:Delete
3:Preorder
4:PostOrder
5:Inorder
6:Display
7:Height Of Tree
8:Find Maximum
9:Search
10:In Order Successor
11:Exit
Enter Your Choice
1
Enter The Data To Be Inserted
35
1:Insert
2:Delete
3:Preorder


1:Insert
2:Delete
3:Preorder
4:PostOrder
5:Inorder
6:Display
7:Height Of Tree
8:Find Maximum
9:Search
10:In Order Successor
11:Exit
Enter Your Choice
0
35
25
15
10
1:Insert
2:Delete
3:Preorder
4:PostOrder
5:Inorder
6:Display
7:Height Of Tree
8:Find Maximum
9:Search
10:In Order Successor
11:Exit
Enter Your Choice
3
15 10 25 35
1:Insert
2:Delete
3:Preorder
4:PostOrder
5:Inorder
6:Display
7:Height Of Tree
8:Find Maximum
9:Search
10:In Order Successor
11:Exit
Enter Your Choice
4
10 35 25 15
1:Insert
2:Delete
3:Preorder
4:PostOrder
5:Inorder
6:Display
7:Height Of Tree
8:Find Maximum
9:Search
10:In Order Successor
11:Exit
Enter Your Choice
5
10 15 25 35
1:Insert
2:Delete
3:Preorder
4:PostOrder