VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.

LAB REPORT
on

DATA STRUCTURES

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
(Autonomous Institution under VTU)
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(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**DATA STRUCTURES**" carried out by **ADITYA S HUDDAR(1BM21CS007),** who is a 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 2022-23. The Lab report has been approved as it satisfies the academic requirements in respect of Data structures Lab **- (22CS3PCDST)** work prescribed for the said degree.

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Course Outcome :

CO1	Apply the concept of linear and nonlinear data structures.
CO2	Analyze data structure operations for a given problem.
CO3	Design and develop solutions using Data Structure concepts.

CO4	Conduct practical experiments for demonstrating the operations of different data structures.

LAB PROGRAM 1:

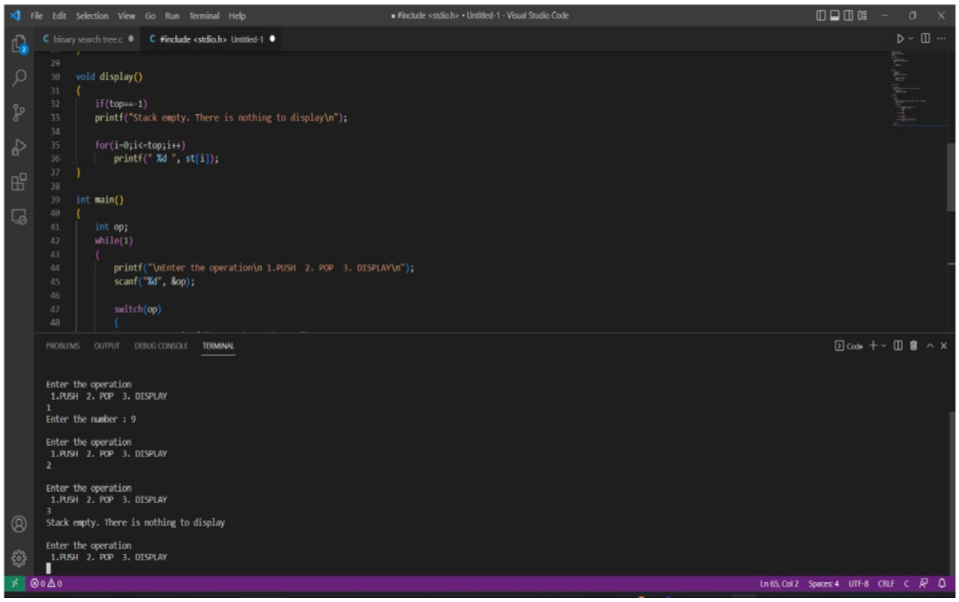
Program to simulate the working of stack using an array.

Program code-C:

```
#include <stdio.h>

#define Stack_size 5

int top, item, st[10],i;

top=-1;


void push()

{

   if (top==Stack_size-1)

   printf("STACK OVERFLOW\n\n\n");

   else

   {

      top++;

st[top]=item;

   }

}

int pop()

{

   int del_item;

if(top==-1)

   printf("STACK UNDERFLOW\n");

   else
   {
       del_item = st[top];
       top--;
       return del_item;
   }
}

void display()
{     if(top==-1)     printf("Stack empty. There is nothing
to display\n");

   for(i=0;i<=top;i++)
       printf(" %d ", st[i]);
}

int main()
{     int op;
while(1)
   {
       printf("\nEnter the operation\n 1.PUSH  2. POP  3. DISPLAY\n");         scanf("%d", &op);

       switch(op)
       {
          case 1: printf("Enter the number : ");
scanf("%d", &item);
                push();
break;
```

```
            case 2: pop();
                    break;

            case 3: display();
                    break;

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

Outputs:



```

void display()
{
    if(top==-1)
    printf("Stack empty. There is nothing to display\n");

    for(i=0;i<=top;i++)
        printf(" %d ", st[i]);
}

int main()
{
    int op;
    while(1)
    {
        printf("\nEnter the operation\n 1.PUSH  2. POP  3. DISPLAY\n");
        scanf("%d", &op);

        switch(op)
        {
```

```
Enter the operation
 1.PUSH  2. POP  3. DISPLAY
1
Enter the number : 9

Enter the operation
 1.PUSH  2. POP  3. DISPLAY
2

Enter the operation
 1.PUSH  2. POP  3. DISPLAY
3
Stack empty. There is nothing to display

Enter the operation
 1.PUSH  2. POP  3. DISPLAY
▌
```

LAB PROGRAM 2:

Program to convert a given infix arithmetic expression to postfix expression.

Program code-C:

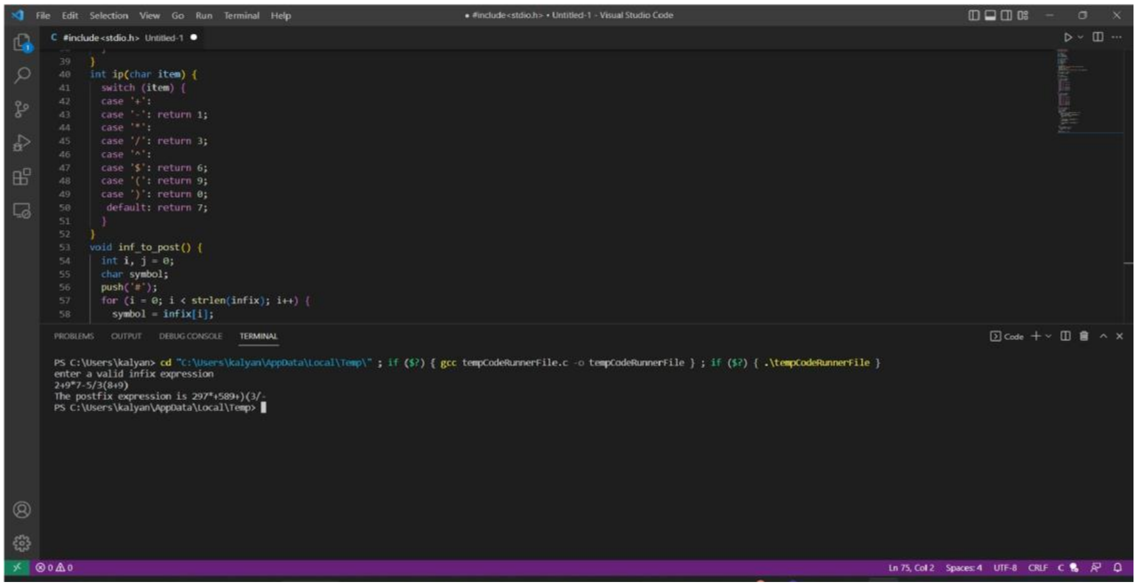
```
#include<stdio.h>
#include<string.h>

int top = -1;
char s[20]; char
infix[20]; char
postfix[20];

void inf_to_post();
int sp(char); int
ip(char); void
push(char); char
pop();

void main() { printf("enter a valid infix
expression\n"); scanf("%s", infix);
inf_to_post(); printf("The postfix expression
is %s", postfix);
}
void push(char item) {
s[++top] = item;
}
```

```
char pop() {
return s[top--]; }
int sp(char item) {
switch (item) {
case '+':
  case '-': return 2;
case '*':
  case '/': return 4;
case '^':
  case '$': return 5;
case '(': return 0;
case '#': return -1;
default: return 8;
  }
}
int ip(char item) {
switch (item) {
case '+': case '-':
return 1; case '*':
case '/': return 3;
case '^':  case '$':
return 6;  case '(':
return 9; case ')':
return 0;    default:
return 7;
  }
}
```

```
void inf_to_post() {
  int i, j = 0;
  char symbol;
  push('#'); for (i = 0; i <
strlen(infix); i++) {     symbol =
infix[i];     while (sp(s[top]) >
ip(symbol)) {       postfix[j] =
pop();
      j++;
    }
    if (sp(s[top] < ip(symbol))) {
push(symbol);
    }
    if (sp(s[top]) == ip(symbol)) {
```

```
    pop();
   }
 }
 while (s[top] != '#') {
postfix[j] = pop();
   j++;
 }
 postfix[j] = '\0';
}
```

Outputs:



```
}
int ip(char item) {
  switch (item) {
  case '+':
  case '-': return 1;
  case '*':
  case '/': return 3;
  case '^':
  case '$': return 6;
  case '(': return 9;
  case ')': return 0;
   default: return 7;
  }
}
void inf_to_post() {
  int i, j = 0;
  char symbol;
  push('#');
  for (i = 0; i < strlen(infix); i++) {
    symbol = infix[i];
```

```
PS C:\Users\kalyan> cd "C:\Users\kalyan\AppData\Local\Temp\" ; if ($?) { gcc tempCodeRunnerFile.c -o tempCodeRunnerFile } ; if ($?) { .\tempCodeRunnerFile }
enter a valid infix expression
2+9*7-5/3(8+9)
The postfix expression is 297*+589+)(3/-
PS C:\Users\kalyan\AppData\Local\Temp> 
```

LAB PROGRAM 3:

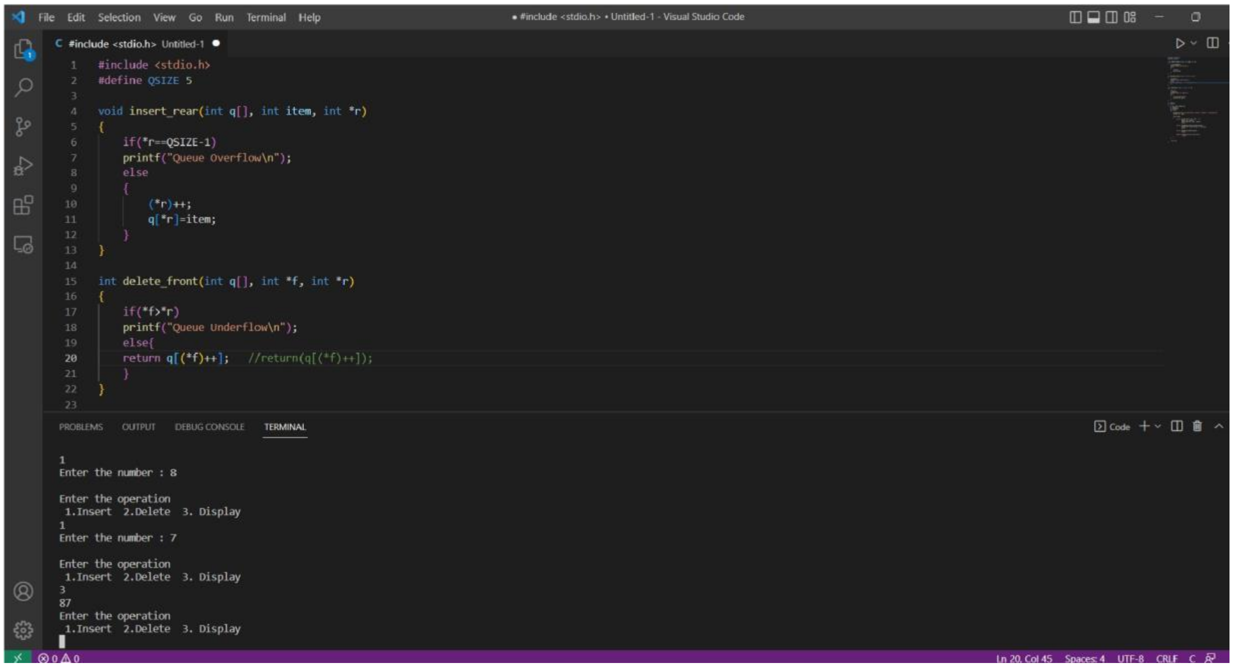
Program to simulate the working of a queue of integers using an array.

Program code-C:

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

void insert_rear(int q[], int item, int *r)
{
   if(*r==QSIZE-1)
printf("Queue Overflow\n");
   else
   {
      (*r)++;
q[*r]=item;
   }
}
int delete_front(int q[], int *f, int *r)
{
if(*f>*r)z
   printf("Queue Underflow\n");
   else{
   return q[(*f)++];  //return(q[(*f)++]);
   }
}

void display(int q[], int *f, int *r)
{
   int i;
   if(*f>*r)
   printf("Queue is empty\n");
   else
   {
       for(i=*f;i<=*r;i++)
printf("%d",q[i]);
   }
}

int main()
{
  int op,item,st[10],val;
int rear=-1;    int
front=0;     while(1)
   {
       printf("\nEnter the operation\n 1.Insert  2.Delete  3. Display\n");
scanf("%d", &op);

       switch(op)
       {
           case 1: printf("Enter the number : ");
scanf("%d", &item);
insert_rear(st, item , &rear);
                   break;

           case 2: val=delete_front(st,&front,&rear);
printf("The value deleted is :%d",val);
                   break;
```

```
        case 3: display(st,&front,&rear);
                break;

        default: printf("Invalid input\n\n");
                 break;
      }
   }

   return 0;
}
```

Outputs:



File Edit Selection View Go Run Terminal Help
• #include <stdio.h> • Untitled-1 - Visual Studio Code
#include <stdio.h> Untitled-1
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Code
Ln 20, Col 45 Spaces: 4 UTF-8 CRLF C

```c
#include <stdio.h>
#define QSIZE 5

void insert_rear(int q[], int item, int *r)
{
    if(*r==QSIZE-1)
    printf("Queue Overflow\n");
    else
    {
        (*r)++;
        q[*r]=item;
    }
}

int delete_front(int q[], int *f, int *r)
{
    if(*f>*r)
    printf("Queue Underflow\n");
    else{
    return q[(*f)++];   //return(q[(*f)++]);
    }
}

```

```
1
Enter the number : 8

Enter the operation
 1.Insert  2.Delete  3. Display
1
Enter the number : 7

Enter the operation
 1.Insert  2.Delete  3. Display
3
87
Enter the operation
 1.Insert  2.Delete  3. Display
```

LAB PROGRAM 4:

Program to simulate the working of a circular queue of integers using an array.

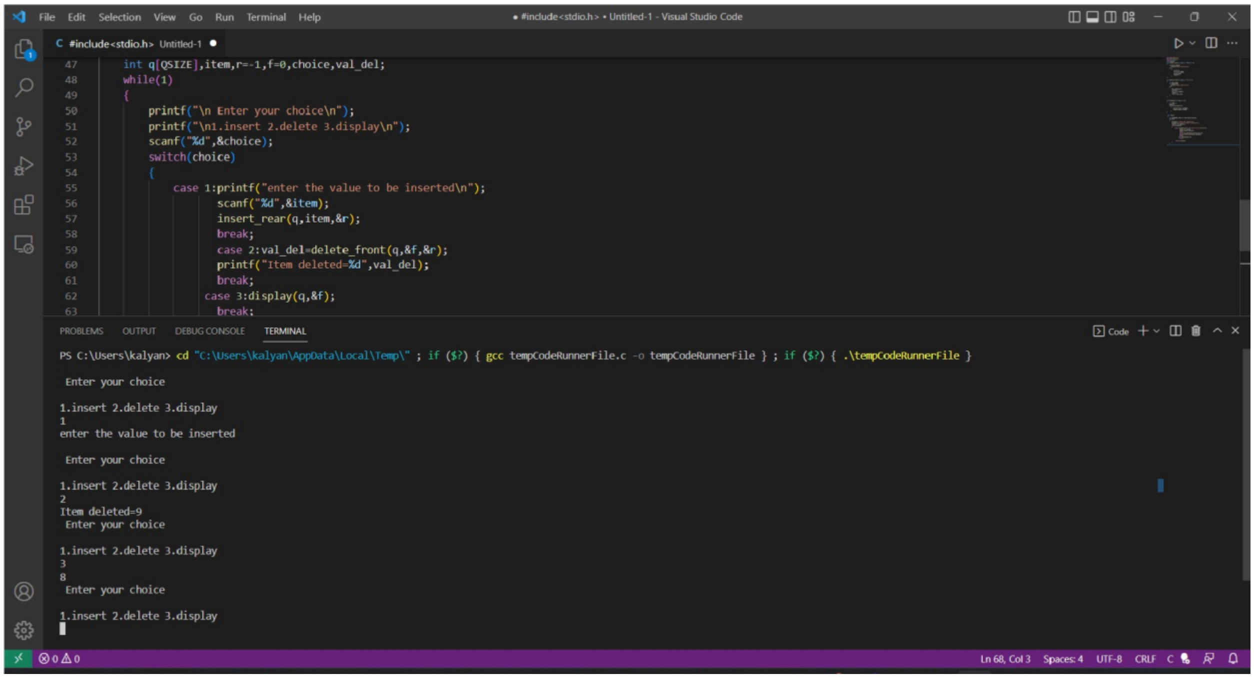
Program code-C:

```
#include<stdio.h>

#include<stdlib.h> #define QSIZE 3 int

count=0; void insert_rear(int q[3],int

item,int *r)

{

   if(count==QSIZE)

printf("Queue overflow\n");

   else

      {

          *r=*r+1;

          *r=(*r)% QSIZE;

q[*r]=item;

count++;

      }

}


int delete_front(int q[3],int *f,int *r)

{

   int del_item;     if (count==0)

printf("Queue underflow\n");

   else

   {

       del_item=q[*f];

*f=*f+1;

*f=((*f)% QSIZE);
```

```
count--;        return
del_item;
   }
}



void display(int q[3],int *f)
{    int temp,i;
temp=*f;
for(i=0;i<count;i++)
{
        printf("%d\t",q[temp]);
temp=(temp+1)% QSIZE;
     }
}

 void main()
 {
   int q[QSIZE],item,r=-1,f=0,choice,val_del;
while(1)
   {
      printf("\n Enter your choice\n");
printf("\n1.insert 2.delete 3.display\n");
scanf("%d",&choice);       switch(choice)
      {
         case 1:printf("enter the value to be inserted\n");
scanf("%d",&item);                insert_rear(q,item,&r);
```

```
              break;

              case 2:val_del=delete_front(q,&f,&r);

printf("Item deleted=%d",val_del);

              break;

            case 3:display(q,&f);

              break;


          default:exit(0);

      }

   }

 }
```

Outputs:



```
    int q[QSIZE],item,r=-1,f=0,choice,val_del;
    while(1)
    {
        printf("\n Enter your choice\n");
        printf("\n1.insert 2.delete 3.display\n");
        scanf("%d",&choice);
        switch(choice)
        {
            case 1:printf("enter the value to be inserted\n");
                  scanf("%d",&item);
                  insert_rear(q,item,&r);
                  break;
                  case 2:val_del=delete_front(q,&f,&r);
                  printf("Item deleted=%d",val_del);
                  break;
                case 3:display(q,&f);
                  break;
```

```
PS C:\Users\kalyan> cd "C:\Users\kalyan\AppData\Local\Temp\" ; if ($?) { gcc tempCodeRunnerFile.c -o tempCodeRunnerFile } ; if ($?) { .\tempCodeRunnerFile }

 Enter your choice

1.insert 2.delete 3.display
1
enter the value to be inserted

 Enter your choice

1.insert 2.delete 3.display
2
Item deleted=9
 Enter your choice

1.insert 2.delete 3.display
3
8
 Enter your choice

1.insert 2.delete 3.display
```

LAB PROGRAM 5:

Program to implement Singly Linked List (Create, Insert and Display functions)

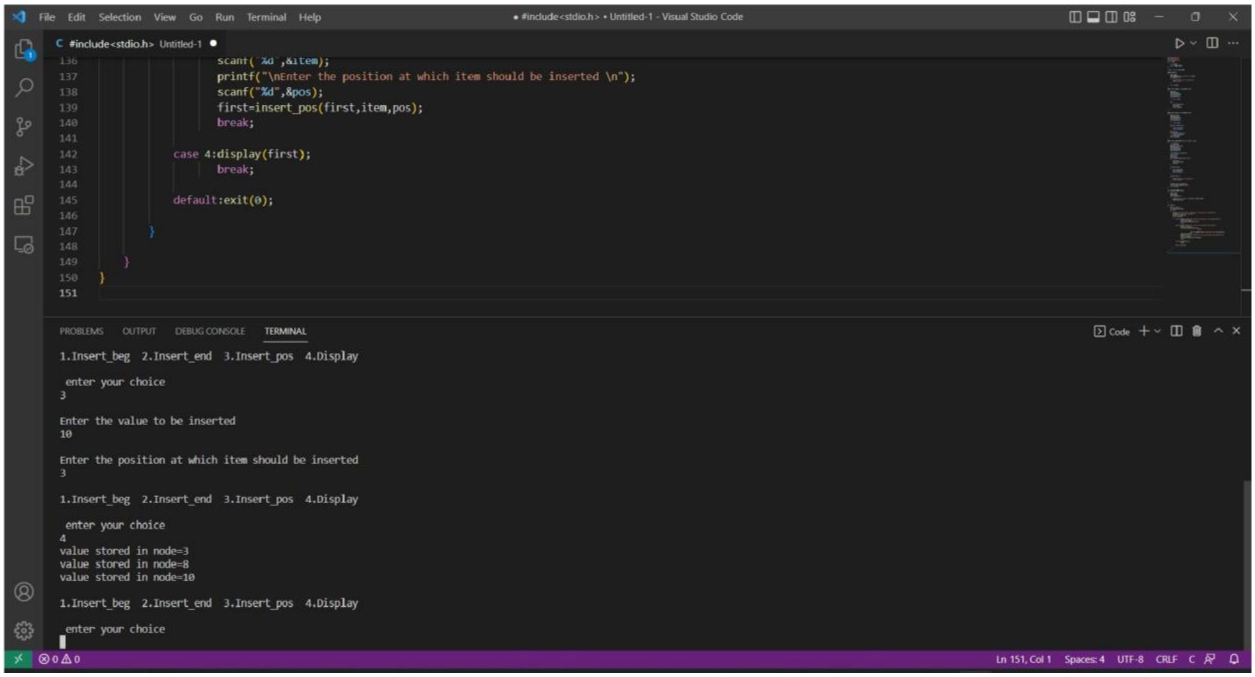
Program code-C:

```
#include<stdio.h>

#include<conio.h>

#include<stdlib.h>

struct node

{

	int value;

	struct node *next;

};


typedef struct node *NODE;


NODE getnode()

{

	NODE temp;

	temp=(NODE)malloc(sizeof(struct node));

	if (temp==NULL)

	{

		printf("Memory not allocated\n");

		return NULL;

	}


	return temp;

}


NODE insert_beg(int item,NODE first)

{
        NODE new;
        new=getnode(); new-
        >value=item; new-
        >next=NULL;
        if(first==NULL)
        {
                return new;
        }
        else
        {
                new->next=first;
                first=new;
                return first;
        }
}

NODE insert_end(int item,NODE first)
{
        NODE new,last;
new=getnode(); new->value=item;
new->next=NULL;
        if (first==NULL)
        {
                return new;
        }
        if(first->next==NULL)
        {
                first->next=new;
                return first;
        }
        last=first;
        while(last->next!=NULL)
                last=last->next; last-
        >next=new;
        return first;
}

NODE insert_pos(NODE first,int item,int pos)
{
        int count=1;
        int val=item;
        NODE new,curr,prev;
        new=getnode(); new-
        >value=item; new->next=NULL;

        if(first==NULL && pos==1)
        return new;
        prev=NULL;
        curr=first;
        while(count!=pos && curr!=NULL)
        {
                prev=curr; curr=curr-
                >next;
                count++;
        }

        if(count==pos)
        {
                prev->next=new; new-
                >next=curr;
                return first;
        }

        if(curr==NULL)
        {
                printf("position not fount\n");
                return first;
        }

        if(first!=NULL && pos==1)
        first=insert_beg(val,first);
        return first;
}
void display(NODE first)
{
        NODE temp;
        temp=first;
        while(temp!=NULL)
        {
                printf("value stored in node=%d\n",temp->value);
                temp=temp->next;
        }
```

```
}

void main()
{
        NODE    first=NULL;
        int choice,pos,item;
        while(1)
        {
                printf("\n1.Insert_beg  2.Insert_end  3.Insert_pos  4.Display\n");
                printf("\n    enter    your    choice\n");    scanf("%d",&choice);
                switch(choice)
                {
                        case 1:printf("\nEnter the value to be inserted at the
                        beginning\n");       scanf("%d",&item);
                        first=insert_beg(item,first);       break;

                        case 2:printf("\nEnter the value to be inserted at the end\n");
                            scanf("%d",&item);
                            first=insert_end(item,first);
                           break;

                    case 3: printf("\nEnter the value to be inserted\n");
                            scanf("%d",&item);       printf("\nEnter the position at which item
                        should be inserted \n");       scanf("%d",&pos);
                        first=insert_pos(first,item,pos);       break;

                        case 4:display(first);
```

```
                                    break;


                        default:exit(0);


                    }


          }

}
```

Outputs:



File Edit Selection View Go Run Terminal Help
• #include<stdio.h> • Untitled-1 - Visual Studio Code
C #include<stdio.h> Untitled-1
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Code
Ln 151, Col 1 Spaces: 4 UTF-8 CRLF C

```
                    scanf("%d",&item);
                    printf("\nEnter the position at which item should be inserted \n");
                    scanf("%d",&pos);
                    first=insert_pos(first,item,pos);
                    break;

                case 4:display(first);
                    break;

                default:exit(0);

            }

        }
    }
```

```
1.Insert_beg  2.Insert_end  3.Insert_pos  4.Display

 enter your choice
3

Enter the value to be inserted
10

Enter the position at which item should be inserted
3

1.Insert_beg  2.Insert_end  3.Insert_pos  4.Display

 enter your choice
4
value stored in node=3
value stored in node=8
value stored in node=10

1.Insert_beg  2.Insert_end  3.Insert_pos  4.Display

 enter your choice
```

LAB PROGRAM 6:

Program to Implement Singly Linked List (Create, Delete and Display functions).

Program code-C:

```
#include<stdio.h>

#include<conio.h>

#include<stdlib.h>

struct node {

   int   value;   struct

node * next;

};

typedef struct node * NODE;

NODE getnode() {     NODE temp;     temp =

(NODE) malloc(sizeof(struct node));     if

(temp == NULL) {        printf("Memory not

allocated\n");        return NULL;

   }

   return temp;

}


NODE insert_beg(int item, NODE first) {

   NODE new;

   new = getnode();

 new -> value = item;

 new -> next = NULL;

   if (first == NULL) {

return new;     } else {
```

```
new -> next = first;
first = new;         return
first;
   }
}

NODE insert_end(int item, NODE first) {
NODE new, last;     new = getnode();
new -> value = item;     new -> next =
NULL;
   if (first == NULL) {
return new;
   }
   if (first -> next == NULL) {
first -> next = new;
return first;
   }
   last = first;
   while (last -> next != NULL)
      last = last -> next;
   last -> next = new;
return first;
}

NODE insert_pos(NODE first, int item, int pos) {
   int count = 1;
int val = item;
```

```
  NODE new, curr, prev;
new = getnode();    new
-> value = item;    new -
> next = NULL;

  if (first == NULL && pos == 1)
return new;    prev = NULL;
  curr = first;
  while (count != pos && curr != NULL) {
    prev = curr;
curr = curr -> next;
count++;
  }

  if (count == pos) {
prev -> next = new;
new -> next = curr;
    return first;
  }
  if (curr == NULL) {
printf("position not fount\n");
    return first;
  }
  if (first != NULL && pos == 1)
    first = insert_beg(val, first);
return first;
}
```

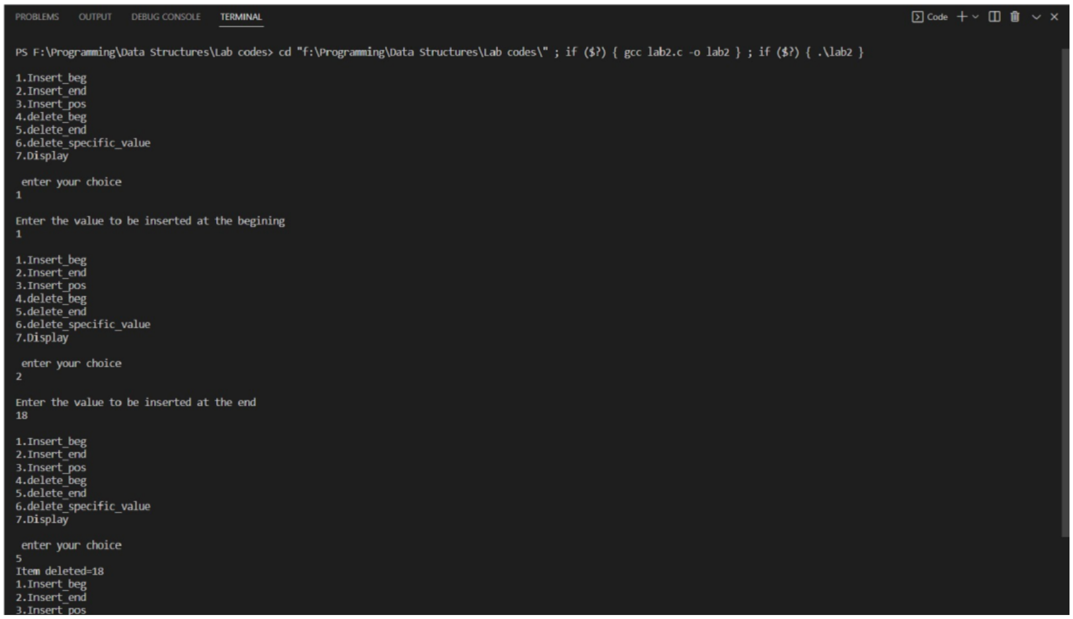
```
NODE delete_beg(NODE first) {
NODE temp;
   if (first == NULL) {
printf("Cannot delete\n");
return NULL;
   }
   temp = first;
   temp = temp -> next;     printf("Item
deleted=%d", first -> value);
   free(first);
   return temp;
}

NODE delete_end(NODE first) {
NODE prev, curr;
   if (first == NULL) {
printf("Cannot delete\n");
return NULL;

   }
   prev = NULL;
   curr = first;
   while (curr -> next != NULL) {
       prev = curr;
curr = curr -> next;
   }
   prev -> next = NULL;     printf("Item
deleted=%d", curr -> value);
```

```
    return first;
}


NODE delete_specific_value(NODE first, int key) {
NODE prev, curr;
    if (first == NULL) {
printf("Cannot delete\n");
return NULL;
    }
    curr = first;     if (curr -> value == key) {
printf("Item deleted=%d", curr -> value);
        first = first -> next;
free(curr);         return
first;
    }
    prev = NULL;
    curr = first;
    while (curr -> value != key && curr != NULL) {
        prev = curr;
curr = curr -> next;
    }
    if (curr -> value == key) {         prev -> next
= curr -> next;         printf("%d=Item
deleted", curr -> value);
        free(curr);
return first;
    }
```

```
   if (curr == NULL) {        printf("End of list reached
and item not fount\n");
      return first;
   }
}

void display(NODE first) {
NODE temp;
   temp = first;     while (temp != NULL) {
printf("value stored in node=%d\n", temp -> value);
temp = temp -> next;
   }
}

void main() {
   NODE first = NULL;
   int choice, pos, item;
while (1) {
      printf("\n1.Insert_beg \n2.Insert_end \n3.Insert_pos \n4.delete_beg \n5.delete_end \
n6.delete_specific_value \n7.Display\n");
      printf("\n enter your choice\n");
scanf("%d", & choice);        switch
(choice) {        case 1:
         printf("\nEnter the value to be inserted at the begining\n");
scanf("%d", & item);            first = insert_beg(item, first);
break;

      case 2:
          printf("\nEnter the value to be inserted at the end\n");
scanf("%d", & item);          first = insert_end(item, first);
break;

      case 3:
          printf("\nEnter the value to be inserted\n");          scanf("%d", &
item);          printf("\nEnter the position at which item should be
inserted \n");          scanf("%d", & pos);          first = insert_pos(first,
item, pos);
          break;

      case 4:
          first = delete_beg(first);
break;

      case 5:          first =
delete_end(first);
break;

      case 6:
          printf("\nEnter the value to be deleted\n");
scanf("%d", & item);          first =
delete_specific_value(first, item);
          break;
```

```
    case 7:
display(first);
break;


    default:
exit(0);


    }
  }
}
```

Outputs:



```
PS F:\Programming\Data Structures\Lab codes> cd "f:\Programming\Data Structures\Lab codes\" ; if ($?) { gcc lab2.c -o lab2 } ; if ($?) { .\lab2 }

1.Insert_beg
2.Insert_end
3.Insert_pos
4.delete_beg
5.delete_end
6.delete_specific_value
7.Display

 enter your choice
1

Enter the value to be inserted at the begining
1

1.Insert_beg
2.Insert_end
3.Insert_pos
4.delete_beg
5.delete_end
6.delete_specific_value
7.Display

 enter your choice
2

Enter the value to be inserted at the end
18

1.Insert_beg
2.Insert_end
3.Insert_pos
4.delete_beg
5.delete_end
6.delete_specific_value
7.Display

 enter your choice
5
Item deleted=18
1.Insert_beg
2.Insert_end
3.Insert_pos
```

LAB PROGRAM 7:

Program to Implement Single Link List (Sort, Reverse and Concatenate list functions).

Program code-C:

```
#include<stdio.h>

#include<stdlib.h>


struct node

{

        int value;

        struct node *next;

};

typedef struct node *NODE;

NODE getnode()

{

        NODE temp;

        temp=(NODE)malloc(sizeof(struct node));

        if(temp==NULL)

        {

                printf("Memory not allocated");

                return NULL;

        }

        return temp;

}

int countfun(NODE first)

{
   NODE temp=first;int c=0;
while(temp!=NULL)
   {
      c++;
      temp=temp->next;
   }
   return c;
}
NODE insert_beg(NODE first,int item)
{
          NODE new;
          new=getnode(); new-
          >value=item; new-
          >next=NULL;
          if(first==NULL)
          {
                    return new;
          }
          else
          {
                    new->next=first;
                    first=new;
                    return first;
          }
}
void display(NODE first)
{
```

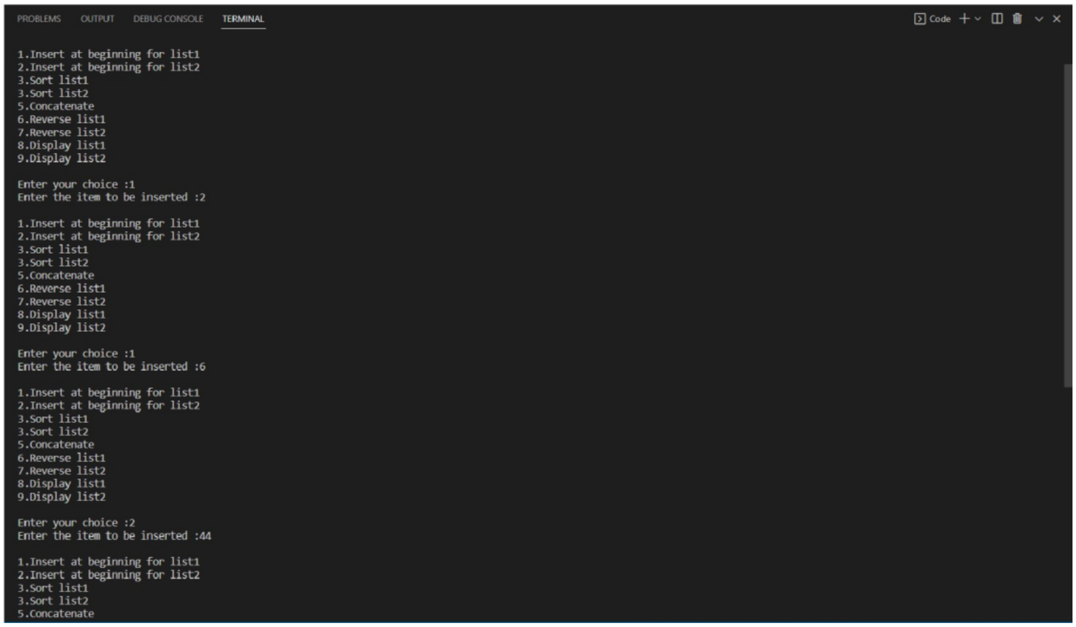
```
            NODE temp;

            temp=first;

            if(first==NULL)

            {

                        printf("List is empty\n");

            }

            while(temp!=NULL)

            {

                        printf("Value stored in the node=%d\n",temp->value);

                        temp=temp->next;

            }


}

NODE sort(NODE first)

{

   NODE curr=first;     int

count=countfun(first);

   int temp,i,j;     if(first-

>next==NULL)

       return first;

   for(i=0;i<count-1;i++)

   {

       curr=first;        for(j=0;j<count-i-

1;j++)

       {

           if(curr->value>curr->next->value)

           {
            temp=curr->value;
            curr->value=curr->next->value;            curr->next-
>value=temp;
         }
         curr=curr->next;
      }
   }
   return first;

}
NODE concatenate(NODE first1, NODE first2)
{
          NODE temp;
          temp=first1; if(first1==NULL &&
          first2==NULL)
          {
                    return NULL;
          }
          if(first1==NULL)
          {
                    return first2;
          }
          while(temp->next!=NULL)
          {
                    temp=temp->next;
          }
          temp->next=first2;
```

```
            return first1;
}
NODE reverse(NODE first)
{
    NODE prev=NULL;
    NODE curr=first;
    NODE next=NULL;
while(curr!=NULL)
    {
        next=curr->next;
curr->next=prev;
prev=curr;
curr=next;

    }
    first=prev;
return prev;
}


int main()
{
            int item,c;
            int  count1=0,count2=0; NODE
            first1=NULL,first2=NULL;
            while(1)
            {
```

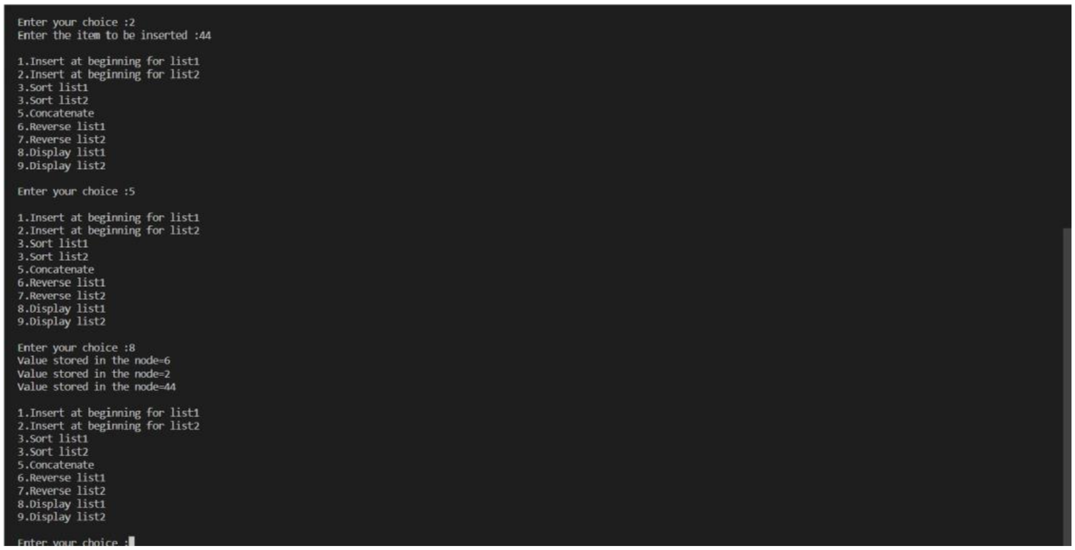
```
            printf("\n1.Insert at beginning for list1\n2.Insert at beginning for list2\n3.Sort
list1\n3.Sort list2\n5.Concatenate(output is stored in list1)\n6.Reverse list1\n7.Reverse list2\
n8.Display list1\n9.Display list2\n\n");

            printf("Enter your choice

            :"); scanf("%d",&c);

            switch(c)

            {

                  case 1:printf("Enter the item to be inserted :");

                        scanf("%d",&item);

                        first1=insert_beg(first1,item);

                        break;

                  case 2:printf("Enter the item to be inserted :");

                        scanf("%d",&item);

                        first2=insert_beg(first2,item);

                        break;

                  case 3:first1=sort(first1);

                  break;

                  case 4:first2=sort(first2);

                  break;

                  case 5:first1=concatenate(first1,first2);

                  break;

                  case 6:first1=reverse(first1);

                  break;

                  case 7:first2=reverse(first2);

                  break;

        case 8:display(first1);

                  break;

                  case 9:display(first2);
```

```
                        break;
                        default:printf("Invalid choice!!!");
                                exit(0);
                }
        }
}
```

Outputs:



```
1.Insert at beginning for list1
2.Insert at beginning for list2
3.Sort list1
3.Sort list2
5.Concatenate
6.Reverse list1
7.Reverse list2
8.Display list1
9.Display list2

Enter your choice :1
Enter the item to be inserted :2

1.Insert at beginning for list1
2.Insert at beginning for list2
3.Sort list1
3.Sort list2
5.Concatenate
6.Reverse list1
7.Reverse list2
8.Display list1
9.Display list2

Enter your choice :1
Enter the item to be inserted :6

1.Insert at beginning for list1
2.Insert at beginning for list2
3.Sort list1
3.Sort list2
5.Concatenate
6.Reverse list1
7.Reverse list2
8.Display list1
9.Display list2

Enter your choice :2
Enter the item to be inserted :44

1.Insert at beginning for list1
2.Insert at beginning for list2
3.Sort list1
3.Sort list2
5.Concatenate
```



```
Enter your choice :2
Enter the item to be inserted :44

1.Insert at beginning for list1
2.Insert at beginning for list2
3.Sort list1
3.Sort list2
5.Concatenate
6.Reverse list1
7.Reverse list2
8.Display list1
9.Display list2

Enter your choice :5

1.Insert at beginning for list1
2.Insert at beginning for list2
3.Sort list1
3.Sort list2
5.Concatenate
6.Reverse list1
7.Reverse list2
8.Display list1
9.Display list2

Enter your choice :8
Value stored in the node=6
Value stored in the node=2
Value stored in the node=44

1.Insert at beginning for list1
2.Insert at beginning for list2
3.Sort list1
3.Sort list2
5.Concatenate
6.Reverse list1
7.Reverse list2
8.Display list1
9.Display list2

Enter your choice :
```

LAB PROGRAM 8:

Program to implement Stack & Queues using Linked Representation.

Program code-C:

Stacks:

```
#include<stdio.h>

#include<conio.h>

#include<stdlib.h>

struct node

{

        int value;

        struct node *next;

};


typedef struct node *NODE;


NODE getnode()

{

        NODE temp;

        temp=(NODE)malloc(sizeof(struct node));

        if (temp==NULL)

        {

                printf("Memory not allocated\n");

                return NULL;

        }


        return temp;

}
```

```
NODE insert_beg(int item,NODE first)
{
        NODE new;
        new=getnode(); new-
        >value=item; new-
        >next=NULL;
        if(first==NULL)
        {
                return new;
        }
        else
        {
                new->next=first;
                first=new;
                return first;
        }
}

NODE delete_beg(NODE first)
{
   NODE temp;
   if(first==NULL)
   {
      printf("Cannot delete\n");
return NULL;
   }
   temp=first;
   temp=temp->next;     printf("Item
deleted=%d",first->value);
   free(first);
   return temp;
}



void display(NODE first)
{
            NODE temp;
            temp=first;
            while(temp!=NULL)
            {
                        printf("value stored in node=%d\n",temp->value);
                        temp=temp->next;
            }
}

void main()
{
            NODE     first=NULL;
            int choice,pos,item;
            while(1)
            {
        printf("\n1.Push \n2.Pop \n3.Display\n");
                        printf("\n enter your choice\n");
                        scanf("%d",&choice);
```

```
                    switch(choice)
      {
         case 1:printf("\nEnter the value to be inserted\n");
                                   scanf("%d",&item);
                                   first=insert_beg(item,first);
              break;

         case 2:first=delete_beg(first);
              break;

         case 3:display(first);
                                   break;

         default:exit(0);

                    }

          }
}
```

Queues:

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

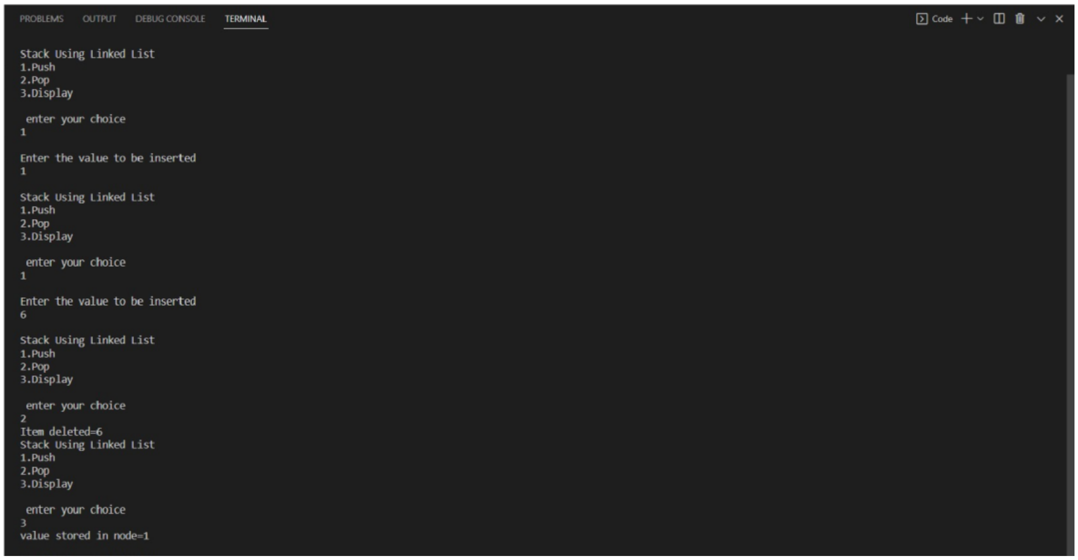
```
};

typedef struct node *NODE;

NODE getnode()
{
        NODE temp;
        temp=(NODE)malloc(sizeof(struct node));
        if (temp==NULL)
        {
                printf("Memory not allocated\n");
                return NULL;
        }

        return temp;
}

NODE insert_beg(int item,NODE first)
{
        NODE new;
        new=getnode(); new-
        >value=item; new-
        >next=NULL;
        if(first==NULL)
        {
                return new;
        }
```

```
            else
            {
                        new->next=first;
                        first=new;
                        return first;
            }
}

NODE delete_end(NODE first)
{
   NODE prev,curr;
if(first==NULL)
    {
      printf("Cannot delete\n");
return NULL;
   }
   prev=NULL;
   curr=first;
   while(curr->next!=NULL)
   {
      prev=curr;        curr=curr-
>next;
   }
   prev->next=NULL;     printf("Item
deleted=%d",curr->value);
   return first;
}
```

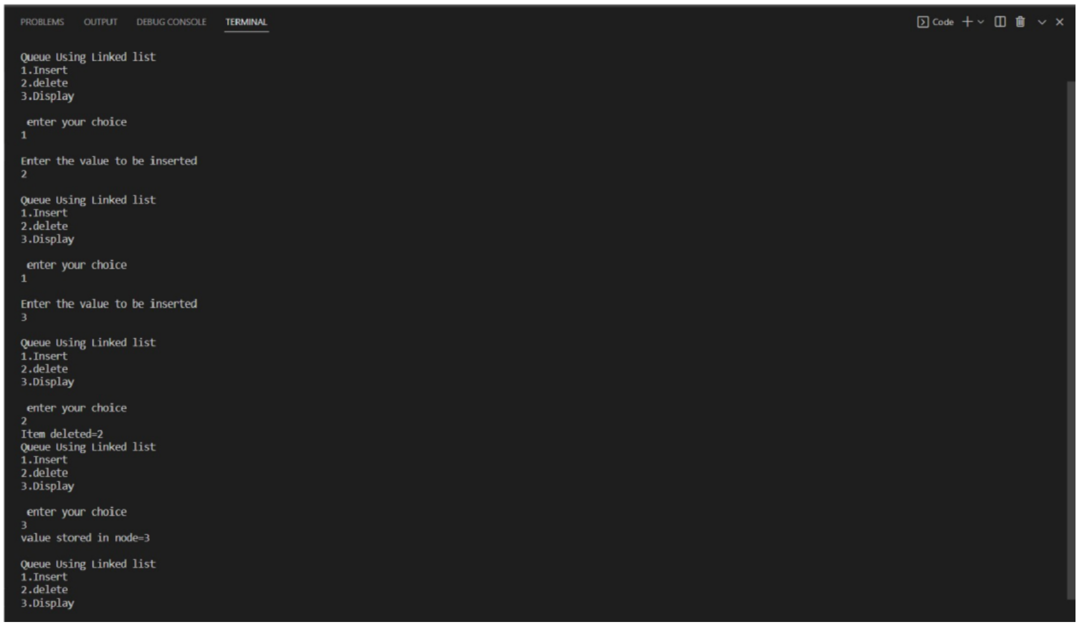
```
void display(NODE first)
{
        NODE temp;
        temp=first;
        while(temp!=NULL)
        {
                printf("value stored in node=%d\n",temp->value);
                temp=temp->next;
        }
}
void main()
{
        NODE    first=NULL;
        int choice,pos,item;
        while(1)
        {
     printf("\n1.Insert \n2.delete \n3.Display\n");
                printf("\n enter your choice\n");
                scanf("%d",&choice);
                switch(choice)
     {
       case 1:printf("\nEnter the value to be inserted\n");
                            scanf("%d",&item);
                            first=insert_beg(item,first);
           break;

       case 2:first=delete_end(first);
```

```
        break;


     case 3:display(first);
                       break;


     default:exit(0);
           }


      }
}
```

Outputs:



```
Stack Using Linked List
1.Push
2.Pop
3.Display

 enter your choice
1

Enter the value to be inserted
1

Stack Using Linked List
1.Push
2.Pop
3.Display

 enter your choice
1

Enter the value to be inserted
6

Stack Using Linked List
1.Push
2.Pop
3.Display

 enter your choice
2
Item deleted=6
Stack Using Linked List
1.Push
2.Pop
3.Display

 enter your choice
3
value stored in node=1
```



```
Queue Using Linked list
1.Insert
2.delete
3.Display

 enter your choice
1

Enter the value to be inserted
2

Queue Using Linked list
1.Insert
2.delete
3.Display

 enter your choice
1

Enter the value to be inserted
3

Queue Using Linked list
1.Insert
2.delete
3.Display

 enter your choice
2
Item deleted=2
Queue Using Linked list
1.Insert
2.delete
3.Display

 enter your choice
3
value stored in node=3

Queue Using Linked list
1.Insert
2.delete
3.Display
```

LAB PROGRAM 9:

Program to Implement doubly link list.

Program code-C:

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

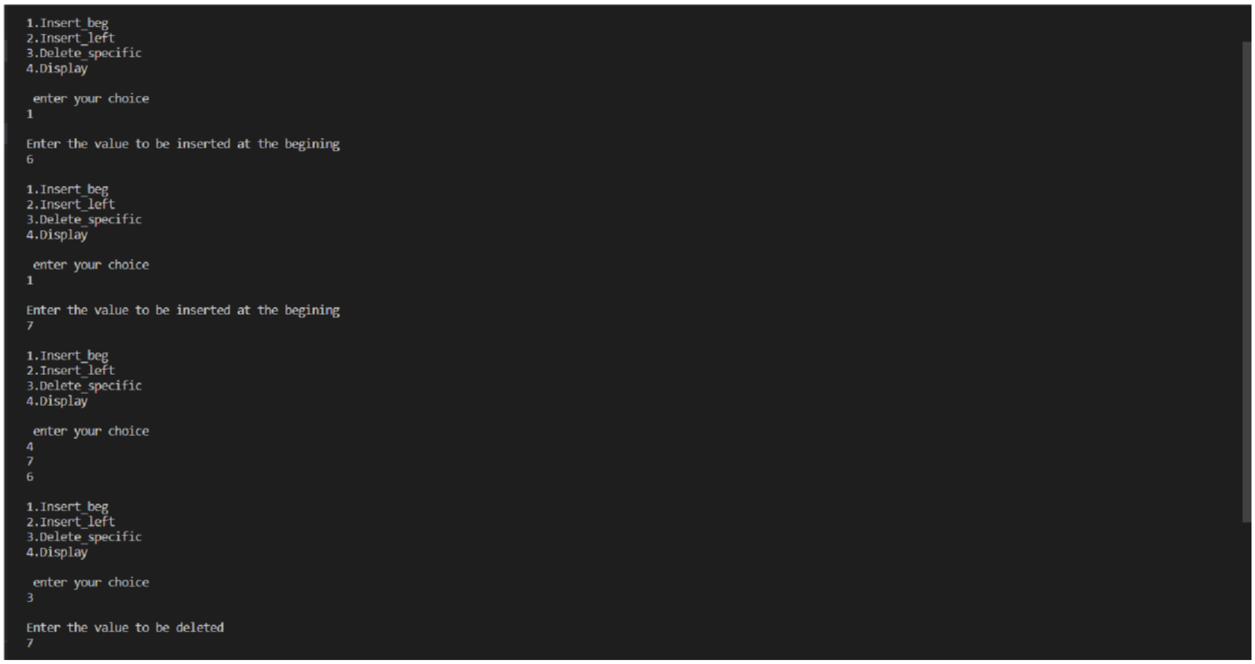
```
#include<conio.h>

#include<stdlib.h>

struct node

{

        int value; struct

        node *next;

        struct node *prev;

};


typedef struct node *NODE;


NODE getnode()

{

        NODE temp;

        temp=(NODE)malloc(sizeof(struct node));

        if(temp==NULL)

        {

                printf("Memory not allocated\n");

        }

        return temp;

}


NODE insert_beg(NODE first,int item)

{

        NODE new;

        new=getnode(); new-

        >value=item; new-
        >prev=NULL; new-
        >next=NULL;
        if(first==NULL)
        {
                return new;
        }
        new->next=first; first-
        >prev=new;
        return new;
}

NODE insert_left(NODE first,int key,int item)
{
        NODE temp,new;
        new=getnode(); new-
        >value=item; new->prev=NULL;
        new->next=NULL;
        if(first==NULL)
        {
                printf("List is empty");
                return NULL;
        }
        if(first->next==NULL && first->value!=key)
        {
                printf("key not found ....cant insert!!!");
                return first;
        }
        if(first->next==NULL && first->value==key)
        {
          first=insert_beg(first,new->value);
        }
        temp=first; while(temp->value!=key && temp-
        >next!=NULL)
        {
                temp=temp->next;
        }
        if(temp->value==key)
        {
                new->next=temp; new->prev=temp-
                >prev; (temp->prev)->next=new; temp-
                >prev=new;
                return first;
        }
        if(temp->value!=key)
        {
                printf("value not found\n");
                return first;
        }
}
NODE delete_specific(NODE first,int key)
{
        NODE curr,temp;
        if(first==NULL)
        {
                printf("Linkedlist is empty\n");
                return NULL;
        }
        if(first->next==NULL && first->value==key)
        { free(first);
                return NULL;
        }
        if(first->next==NULL && first->value!=key)
        {
                printf("element not found\n");
                return first;
        }
        if(first->value==key)
        {
                (first->next)->prev=NULL; temp=first-
                >next;
                free(first);
                return temp;
        }
        while(curr!=NULL)
        {
                if(curr->value==key)
                break;
                curr=curr->next;
        }
        if(curr==NULL)
        {
```

```
                printf("Element not found\n");
        }
        (curr->prev)->next=curr->next; if(curr-
        >next!=NULL)
        {
                (curr->next)->prev=curr->prev;
        }
}

void display(NODE first)
{
        NODE temp;
        if(first==NULL)
        {
                printf("List is empty\n");
        }
        temp=first;
        while(temp!=NULL)
        {
                printf("%d\n",temp->value); temp=temp-
                >next;

        }
}

void main()
{
```

```
NODE     first=NULL;

int choice,key,item;

while(1)

{

        printf("\n1.Insert_beg  2.Insert_left  3.Delete_specific  4.Display\n");

        printf("\n enter your choice"); scanf("%d",&choice); switch(choice)

        {

                case 1:printf("\nEnter the value to be inserted at the

                begining\n");       scanf("%d",&item);

                first=insert_beg(first,item);       break;


                case 2:printf("\nEnter the value to be inserted at the

                left\n");       scanf("%d",&item);       printf("\nEnter the

                key\n");       scanf("%d",&key);

                    first=insert_left(first,key,item);

   break;


  case 3:printf("\nEnter the value to be deleted\n");

                    scanf("%d",&key);

                    first=delete_specific(first,key);

                break;


                case 4:display(first);

                    break;


          default:exit(0);
```

```
                }


        }
```

Outputs:



```
1.Insert_beg
2.Insert_left
3.Delete_specific
4.Display

 enter your choice
1

Enter the value to be inserted at the begining
6

1.Insert_beg
2.Insert_left
3.Delete_specific
4.Display

 enter your choice
1

Enter the value to be inserted at the begining
7

1.Insert_beg
2.Insert_left
3.Delete_specific
4.Display

 enter your choice
4
7
6

1.Insert_beg
2.Insert_left
3.Delete_specific
4.Display

 enter your choice
3

Enter the value to be deleted
7
```

LAB PROGRAM 10:

Program to Implement a Binary Search Tree (Create, Traversal and Display functions).

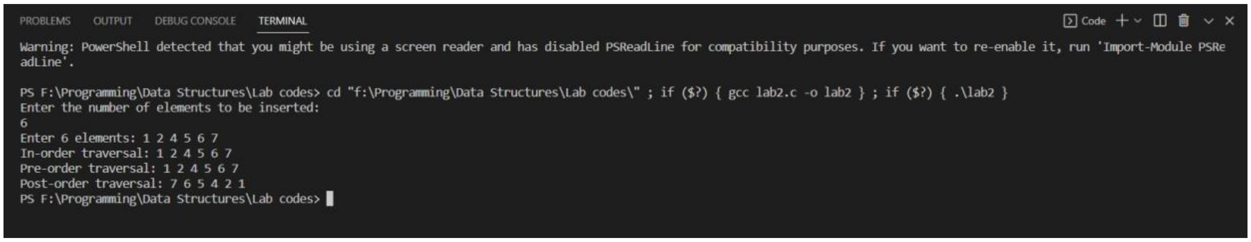
Program code-C:

```
#include <stdio.h>

#include <stdlib.h>


struct node
```

```
{    int data;    struct
node *left;    struct
node *right;
};

struct node *insert(struct node *node, int data)
{
   if (node == NULL)
   {
      struct node *temp = (struct node *)malloc(sizeof(struct node));
temp->data = data;       temp->left = temp->right = NULL;
return temp;
   }

   if (data < node->data)
      node->left = insert(node->left, data);
   else if (data > node->data)       node-
>right = insert(node->right, data);

   return node;
}
```

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

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

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

int main()
{
   struct node *root = NULL;
int n, i, element;

   printf("Enter the number of elements to be inserted:
");     scanf("%d", &n);     printf("Enter %d elements: ", n);
   for (i = 0; i < n; i++)
   {
       scanf("%d", &element);
root = insert(root, element);
   }

   printf("In-order traversal: ");
inorder(root);     printf("\nPre-
order traversal: ");
preorder(root);     printf("\nPost-
order traversal: ");
postorder(root);


    return 0;
}
```

Outputs:



```
Warning: PowerShell detected that you might be using a screen reader and has disabled PSReadLine for compatibility purposes. If you want to re-enable it, run 'Import-Module PSRe
adLine'.

PS F:\Programming\Data Structures\Lab codes> cd "f:\Programming\Data Structures\Lab codes\" ; if ($?) { gcc lab2.c -o lab2 } ; if ($?) { .\lab2 }
Enter the number of elements to be inserted:
6
Enter 6 elements: 1 2 4 5 6 7
In-order traversal: 1 2 4 5 6 7
Pre-order traversal: 1 2 4 5 6 7
Post-order traversal: 7 6 5 4 2 1
PS F:\Programming\Data Structures\Lab codes>
```