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Sec: 3B

Subject: Data Structure Lab

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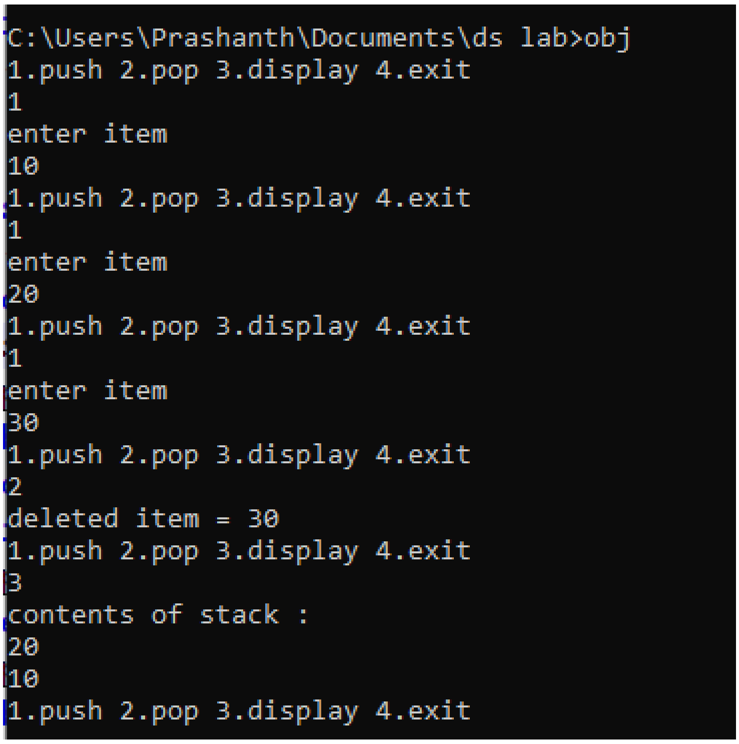
Lab Program 1:

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

```
#include<stdio.h>
#include<conio.h>
#include<stdlib.h>
#define STACK_SIZE 5
int top=-1;
void push(int item,int s[])
{
if(top==STACK_SIZE -1)
{
printf("stack overflow \n");
return;
}
top=top+1;
s[top]=item;
}
int pop(int s[])
{
if(top==-1)
{
```

```
printf("stack underflow \n");
return(-1);
}
return(s[top--]);
}
void display(int s[])
{
if(top==-1)
{
printf("empty stack \n");
return;
}
printf("contents of stack :\n");
for(int i=top;i>=0;i--)
printf("%d \n",s[i]);
}
void main()
{
int item,n,s[10],item_del;
for(;;)
{

    printf("enter \n 1.push \n 2.pop \n 3.display \n 4.exit \n");
    scanf("%d",&n);
```

```
switch(n)
{
case 1:printf("enter item \n");
scanf("%d ",&item);
push(item,s);
break;
case 2:item_del=pop(s);
if(item_del==-1)
printf("empty stack \n");
else
printf("deleted item = %d \n",item_del);
break;
case 3:display(s);
break;
default:exit(0);
}
}
getch();
}
```



```
C:\Users\Prashanth\Documents\ds lab>obj
1.push 2.pop 3.display 4.exit
1
enter item
10
1.push 2.pop 3.display 4.exit
1
enter item
20
1.push 2.pop 3.display 4.exit
1
enter item
30
1.push 2.pop 3.display 4.exit
2
deleted item = 30
1.push 2.pop 3.display 4.exit
3
contents of stack :
20
10
1.push 2.pop 3.display 4.exit
```

Lab Program 2:

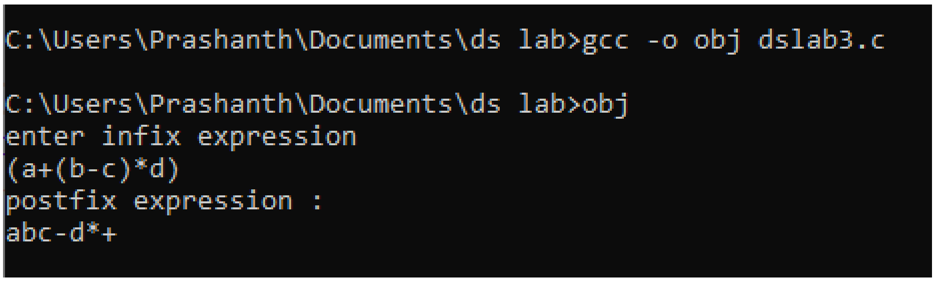
WAP to convert a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide) 1

```
#include<stdio.h>

#include<string.h>

#include<conio.h>

int F(char symbol)

{

        switch(symbol)

        {

                case '+':

                case '-':return(2);

                case '*':
```

```
        case '/':return(4);
        case '^':
        case '$':return(5);
        case '(':return(0);
        case '#':return(-1);
        default:return(8);
    }
}
int G(char symbol)
{
    switch(symbol)
    {
        case '+':
        case '-':return(1);
        case '*':
        case '/':return(3);
        case '^':
        case '$':return(6);
        case '(':return(9);
        case ')':return(0);
        default:return(7);
    }
}
void infix_postfix(char infix[],char postfix[])
```

```
{
        int top,i,j;
        char s[30],symbol;
        top=-1;
        j=0;
        s[++top]='#';
        for(i=0;i<strlen(infix);i++)
        {
                symbol=infix[i];
                while(F(s[top])>G(symbol))
                {
                postfix[j]=s[top--];
                j++;
                }
                if(F(s[top])!=G(symbol))
                        s[++top]=symbol;
                else
                        top--;
        }
                while(s[top]!='#')
                        postfix[j++]=s[top--];

        postfix[j]='\0';
}
```

```
void main()

{

   char infix[20];

   char postfix[20];

   printf("enter infix expression \n");

   gets(infix);

   infix_postfix(infix,postfix);

   printf("postfix expression :\n");

   puts(postfix);

   getch();


}
```



```
C:\Users\Prashanth\Documents\ds lab>gcc -o obj dslab3.c

C:\Users\Prashanth\Documents\ds lab>obj
enter infix expression
(a+(b-c)*d)
postfix expression :
abc-d*+
```

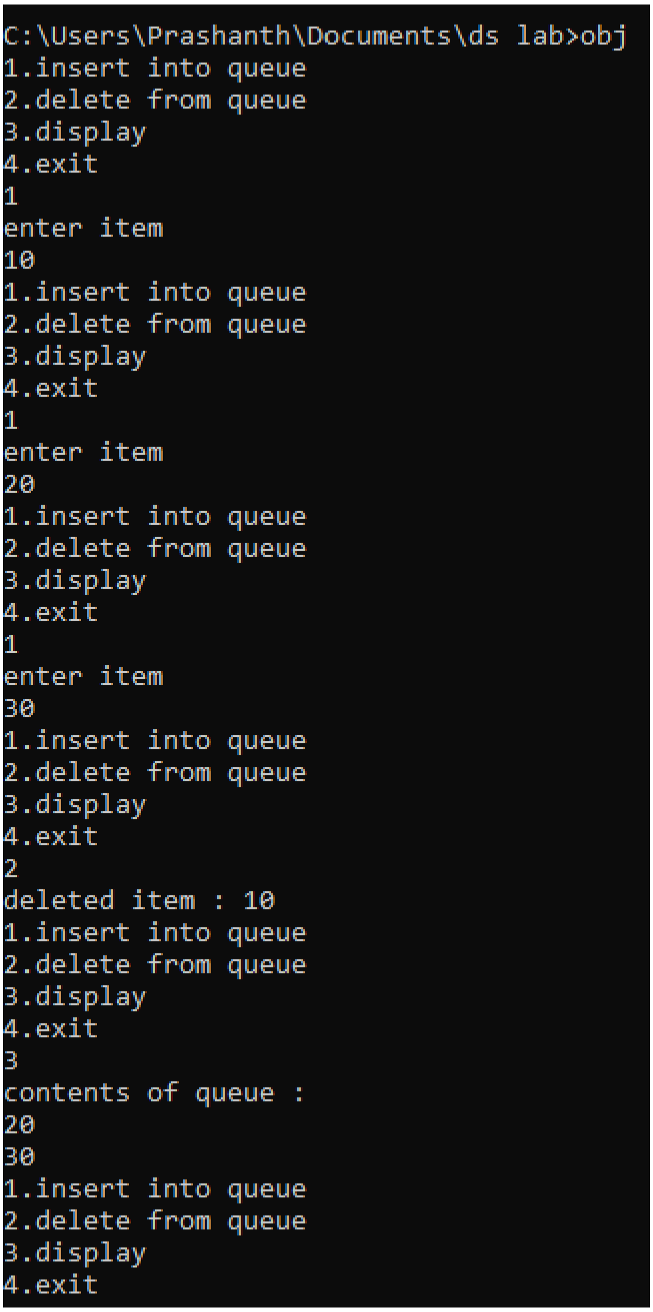
Lab Program 3:

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 conditions

```
#include<stdio.h>

#include<conio.h>

#include<process.h>

#include<stdlib.h>
```

```
#define QUE_SIZE 5
int item,front=0,rear=-1,q[10];
void insert()
{
if(rear==QUE_SIZE -1)
{
printf("queue overflow \n");
return;
}
rear=rear+1;
q[rear]=item;
}
int delete()
{
if(front>rear)
{
front=0;
rear=-1;
return(-1);
}
return(q[front++]);
}
void display()
{
```

```
if(front>rear)
{
printf("queue is empty \n");
return;
}
printf("contents of queue :\n");
for(int i=front;i<=rear;i++)
printf("%d \n",q[i]);
}
void main()
{
int n;
for(;;)
{
        printf("1.insert into queue \n2.delete from queue \n3.display 
\n4.exit\n");
        scanf("%d",&n);
        switch(n)
        {
                case 1:printf("enter item \n");
                scanf("%d",&item);
                insert();
                break;
                case 2:item=delete();
                if(item==-1)
                        printf("queue is empty\n");
                else
                        printf("deleted item : %d\n",item);
                break;
                case 3:display();
                break;
                default:exit(0);
        }
}
}
```



```
C:\Users\Prashanth\Documents\ds lab>obj
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
10
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
20
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
30
1.insert into queue
2.delete from queue
3.display
4.exit
2
deleted item : 10
1.insert into queue
2.delete from queue
3.display
4.exit
3
contents of queue :
20
30
1.insert into queue
2.delete from queue
3.display
4.exit
```

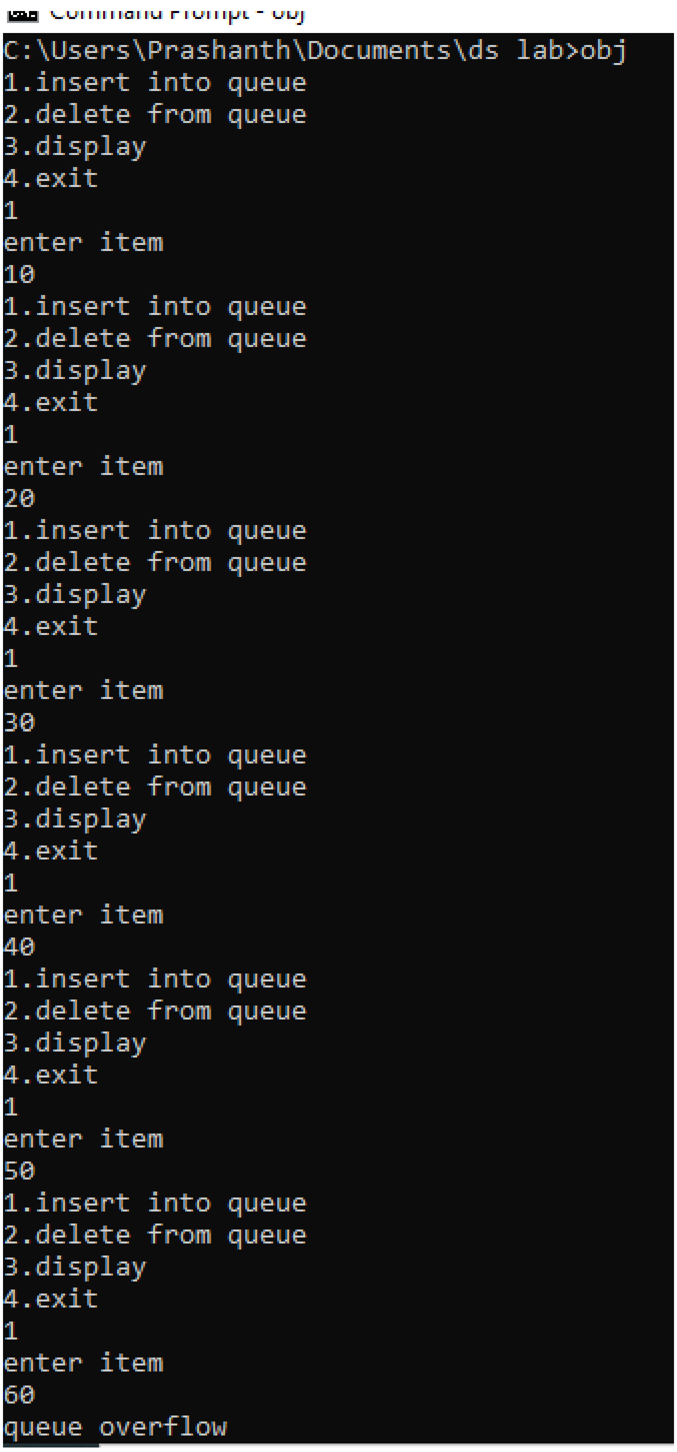
Lab program 4:

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 conditions

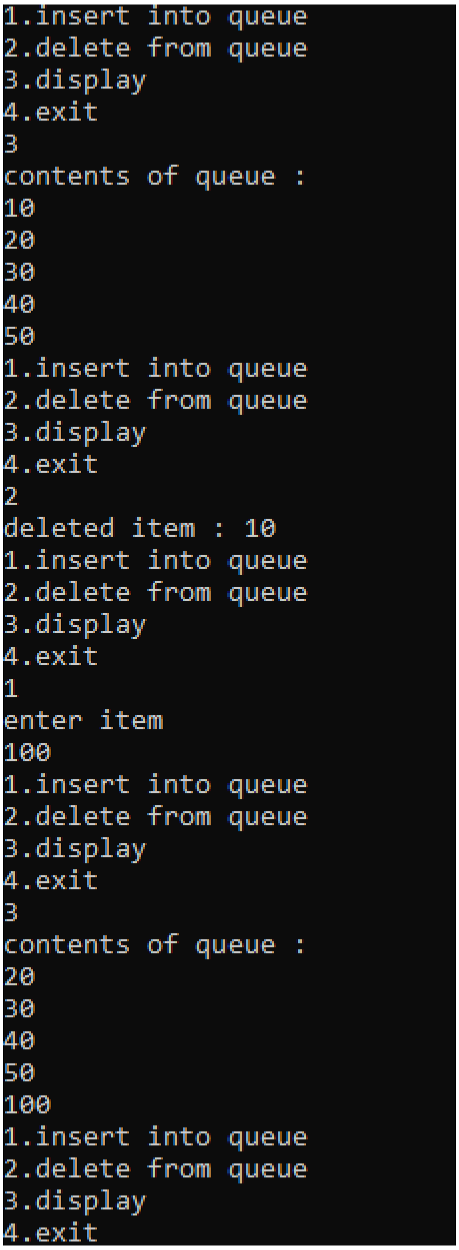
```
/*circular queue*/
#include<stdio.h>
#include<conio.h>
#include<process.h>
```

```
#include<stdlib.h>
#define QUE_SIZE 5
int item,front=0,rear=-1,q[10],count=0;
void insert()
{
if(count==QUE_SIZE)
{
printf("queue overflow \n");
return;
}
rear=(rear+1)%QUE_SIZE;
q[rear]=item;
count++;
}
int delete()
{
if(count==0)
{
return(-1);
}
item=q[front];
front=(front+1)%QUE_SIZE;
count--;
return(item);
}
void display()
{
if(count==0)
{
printf("queue is empty \n");
return;
}
printf("contents of queue :\n");
int f=front;
for(int i=1;i<=count;i++)
{
        printf("%d \n",q[f]);
        f=(f+1)%QUE_SIZE;
}
}
```

```
void main()
{
int n;
for(;;)
{
        printf("1.insert into queue \n2.delete from queue \n3.display
\n4.exit\n");
        scanf("%d",&n);
        switch(n)
        {
                case 1:printf("enter item \n");
                scanf("%d",&item);
                insert();
                break;
                case 2:item=delete();
                if(item==-1)
                        printf("queue is empty\n");
                else
                        printf("deleted item : %d\n",item);
                break;
                case 3:display();
                break;
                default:exit(0);
        }
}
}
```



```
C:\Users\Prashanth\Documents\ds lab>obj
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
10
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
20
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
30
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
40
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
50
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
60
queue overflow
```



```
1.insert into queue
2.delete from queue
3.display
4.exit
3
contents of queue :
10
20
30
40
50
1.insert into queue
2.delete from queue
3.display
4.exit
2
deleted item : 10
1.insert into queue
2.delete from queue
3.display
4.exit
1
enter item
100
1.insert into queue
2.delete from queue
3.display
4.exit
3
contents of queue :
20
30
40
50
100
1.insert into queue
2.delete from queue
3.display
4.exit
```

Lab Program 5:

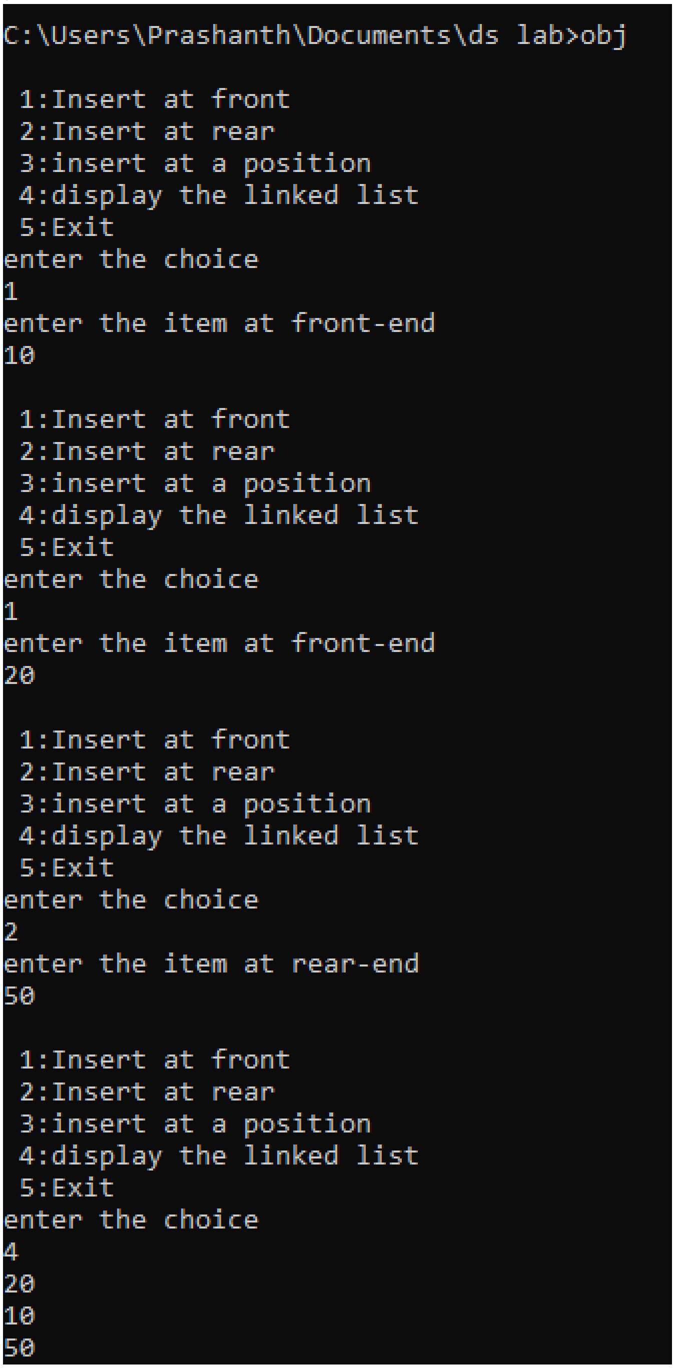
WAP to Implement Singly Linked List with following operations a) Create a linked list. b) Insertion of a node at first position, at any position and at end of list. c) Display the contents of the linked list.

```
#include<stdio.h>
#include<conio.h>
#include<malloc.h>
#include<process.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;
}

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 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;
```

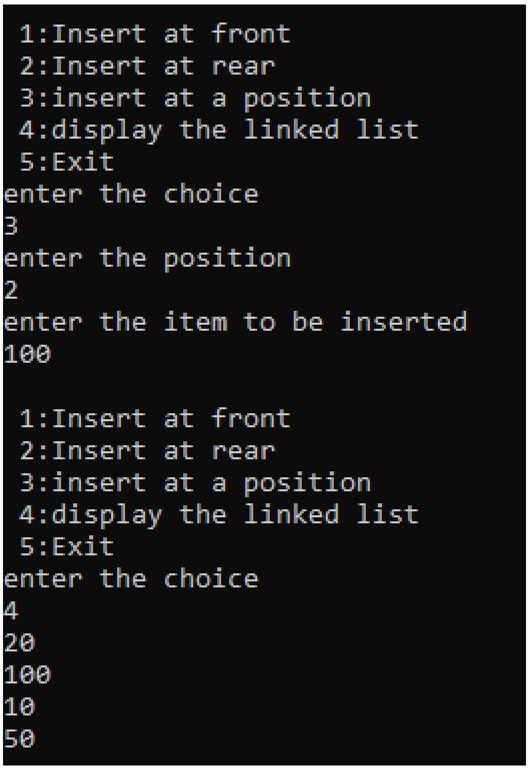
```
return first;
}

NODE 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("IP\n");
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);
  }
}
void main()
{
int item,choice,pos;
NODE first=NULL;

for(;;)
{
printf("\n 1:Insert at front\n 2:Insert at rear\n 3:insert at a position\n
4:display the linked list \n 5: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:printf("enter the item at rear-end\n");
            scanf("%d",&item);
            first=insert_rear(first,item);
            break;

  case 3:printf("enter the position\n");
                       scanf("%d",&pos);
                       printf("enter the item to be inserted \n");
                       scanf("%d",&item);

                       first=insert_pos(item,pos,first);
```

```
                    break;
  case 4:display(first);
          break;
 default:exit(0);

 }
}
getch();
}
```



```
C:\Users\Prashanth\Documents\ds lab>obj

 1:Insert at front
 2:Insert at rear
 3:insert at a position
 4:display the linked list
 5:Exit
enter the choice
1
enter the item at front-end
10

 1:Insert at front
 2:Insert at rear
 3:insert at a position
 4:display the linked list
 5:Exit
enter the choice
1
enter the item at front-end
20

 1:Insert at front
 2:Insert at rear
 3:insert at a position
 4:display the linked list
 5:Exit
enter the choice
2
enter the item at rear-end
50

 1:Insert at front
 2:Insert at rear
 3:insert at a position
 4:display the linked list
 5:Exit
enter the choice
4
20
10
50
```



```
 1:Insert at front
 2:Insert at rear
 3:insert at a position
 4:display the linked list
 5:Exit
enter the choice
3
enter the position
2
enter the item to be inserted
100

 1:Insert at front
 2:Insert at rear
 3:insert at a position
 4:display the linked list
 5:Exit
enter the choice
4
20
100
10
50
```

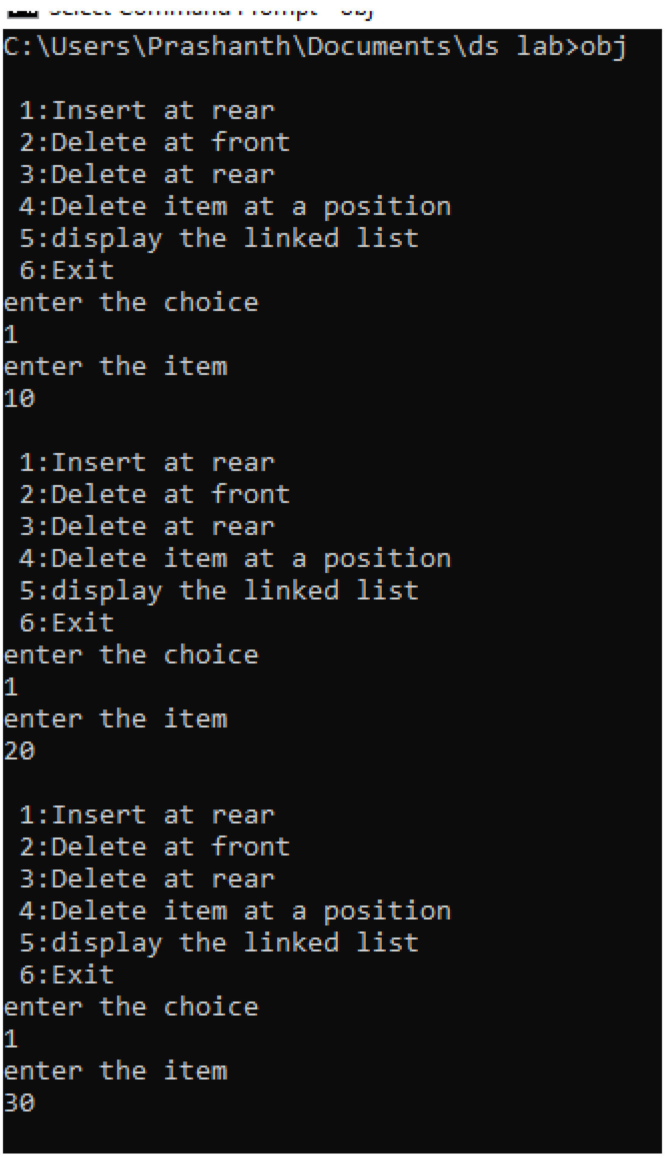
Lab Program 6:

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.

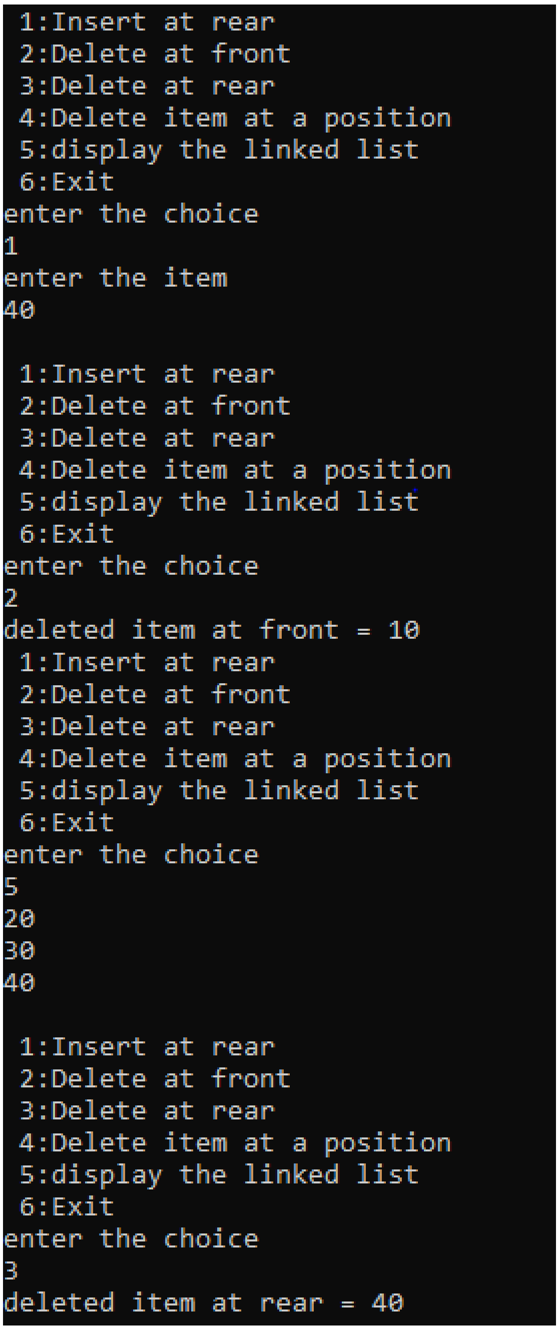
```
#include<stdio.h>
#include<conio.h>
#include<malloc.h>
#include<process.h>
struct node
{
  int info;
  struct node *link;
};
typedef struct node *NODE;
NODE getnode()
{
NODE x;
x=(NODE)malloc(sizeof(struct node));
if(x==NULL)
 {
  printf("mem full\n");
  exit(0);
 }
 return x;
}


NODE insert(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 delete_front(NODE first)
{
	NODE temp;
	if(first==NULL)
	{
		printf("list is empty \n");
		return first;
	}
	temp=first;
	temp=temp->link;
	printf("deleted item at front = %d ",first->info);
	free(first);
	return temp;
}
NODE delete_rear(NODE first)
{
	NODE cur,prev;
	if(first==NULL)
	{
		printf("list is empty \n");
		return first;
```

```
        }
        if(first->link==NULL)
        {
                printf("only one item in list and delete item  = %d ",first->info);
           free(first);
                return NULL;
        }
        prev=NULL;
        cur=first;
        while(cur->link!=NULL)
        {
                prev=cur;
                cur=cur->link;
        }
        printf("deleted item at rear = %d ",cur->info);
        free(cur);
        prev->link=NULL;
        return first;
}

NODE delete_pos(int pos,NODE first)
{
        NODE cur,prev;
        int count;
        if(first==NULL)
        {
                printf("list is empty \n");
                return first;
        }
        if(pos<=0)
   {
                printf("invalid pos value \n");
                return first;
        }
        if(pos==1)
        {
                cur=first;
                first=first->link;
                printf("deleted item at position %d  = %d ",pos,cur->info);
                free(cur);
                return first;
        }
        prev=NULL;
        cur=first;
        count=1;
        while(cur->link!=NULL)
        {
                if(count==pos)
                        break;
                prev=cur;
                cur=cur->link;
                count++;
        }
        if(count!=pos)
        {
                printf("invalid pos value \n");
                return first;
        }
        prev->link=cur->link;
        printf("deleted item at position %d = %d ",pos,cur->info);
        free(cur);
        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);
  }
}
void main()
{
int item,choice,pos;
NODE first=NULL;

for(;;)
```

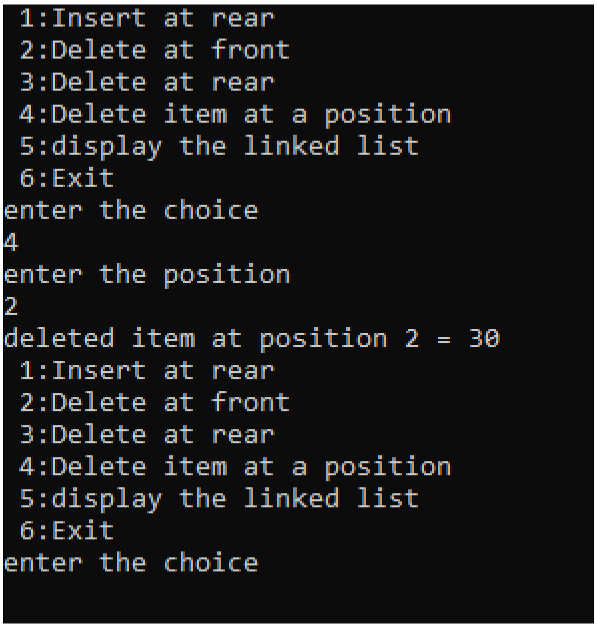
```
{
printf("\n 1:Insert at rear\n 2:Delete at front\n 3:Delete at rear\n 4:Delete
item at a position\n 5:display the linked list \n 6:Exit\n");
printf("enter the choice\n");
scanf("%d",&choice);
switch(choice)
 {
  case 1:printf("enter the item \n");
          scanf("%d",&item);
          first=insert(first,item);
          break;

  case 2:
          first=delete_front(first);
          break;
  case 3: first=delete_rear(first);
  break;

  case 4:printf("enter the position\n");
                    scanf("%d",&pos);
                    first=delete_pos(pos,first);
                    break;
  case 5:display(first);
          break;
 default:exit(0);

 }
}
getch();
}
```



```
C:\Users\Prashanth\Documents\ds lab>obj

 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
1
enter the item
10

 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
1
enter the item
20

 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
1
enter the item
30
```



```
 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
1
enter the item
40

 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
2
deleted item at front = 10
 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
5
20
30
40

 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
3
deleted item at rear = 40
```



```
 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
4
enter the position
2
deleted item at position 2 = 30
 1:Insert at rear
 2:Delete at front
 3:Delete at rear
 4:Delete item at a position
 5:display the linked list
 6:Exit
enter the choice
```

Lab Program 7 and Lab Program 8:

WAP Implement Single Link List with following operations a) Sort the linked list. b) Reverse the linked list. c) Concatenation of two linked lists d) Stack and Queue Implementation

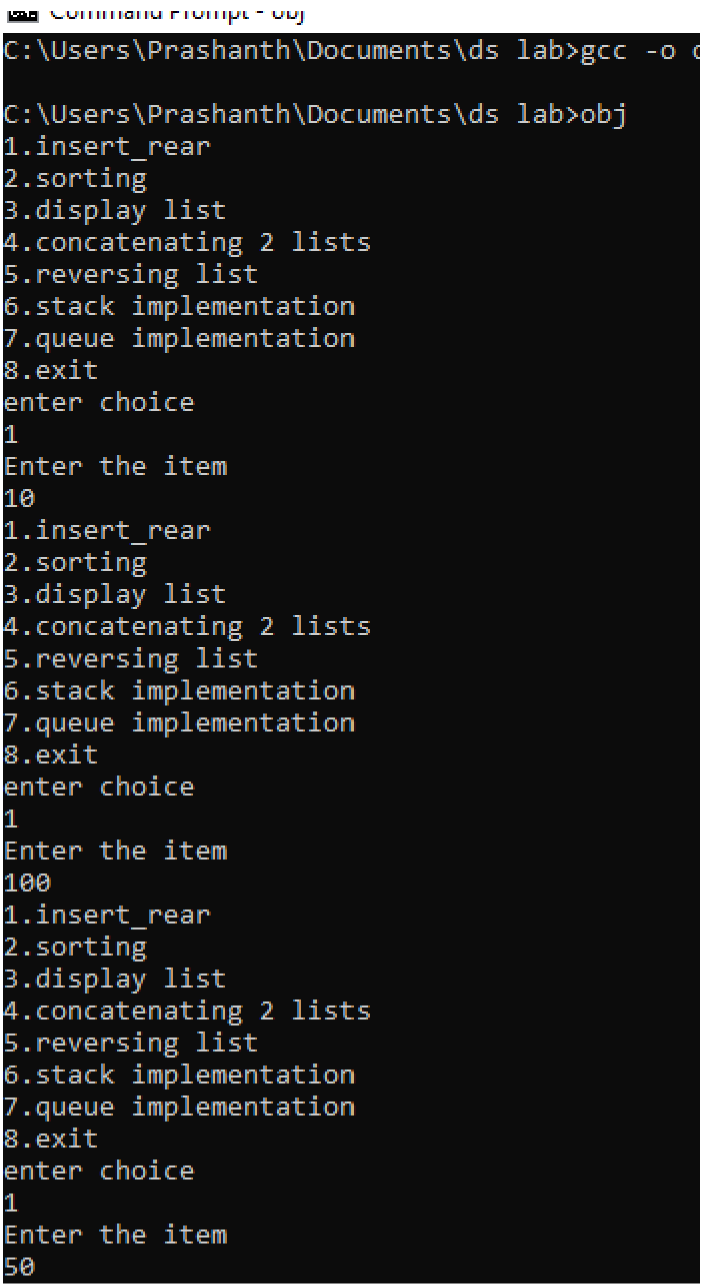
```
/*singly linked list operations 1.sorting 2.reversing 3.concatenating 4.stack
queue implementation */
#include<stdio.h>
#include<conio.h>
#include<malloc.h>
#include<process.h>
struct node
{
  int info;
  struct node *link;
};
typedef struct node *NODE;
NODE getnode()
{
NODE x;
x=(NODE)malloc(sizeof(struct node));
if(x==NULL)
 {
  printf("mem full\n");
  exit(0);
 }
 return x;
}
```

```
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;
}
void display(NODE first)
{
NODE temp;
if(first==NULL)
printf("list is empty");
printf("contents : \n");
for(temp=first;temp!=NULL;temp=temp->link)
{
printf("%d\n",temp->info);
}
}
NODE sort(NODE first)
{
int swapped;
NODE ptr1;
NODE lptr = NULL;
if (first == NULL)
return NULL;
do
   {
       swapped = 0;
       ptr1 = first;

       while (ptr1->link != lptr)
```

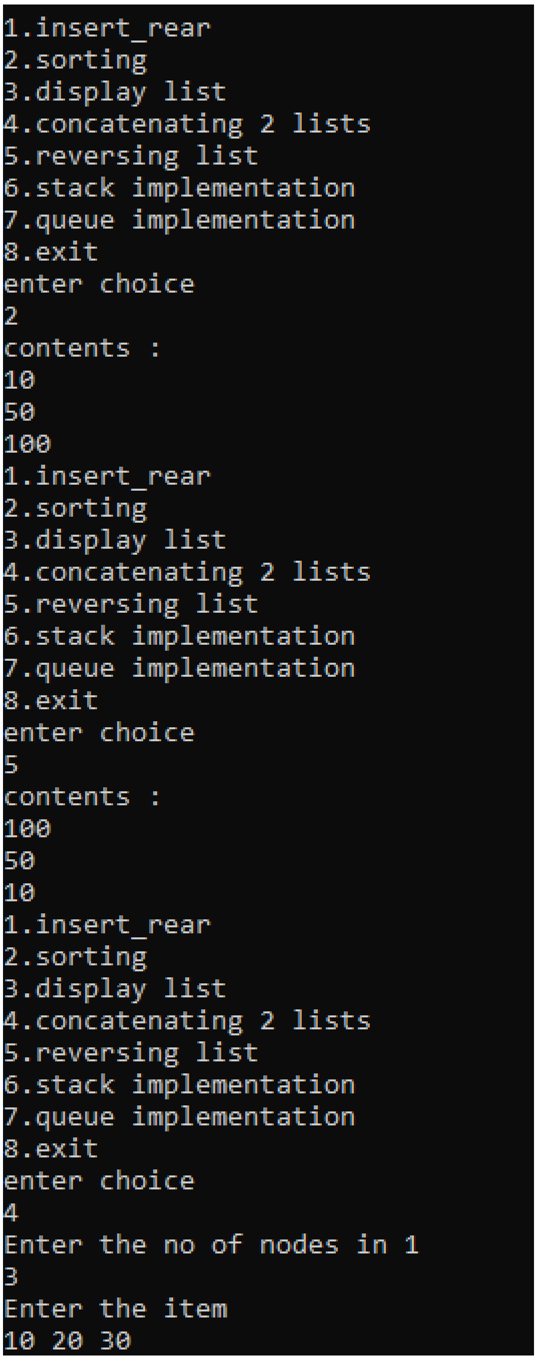
```
        {
            if (ptr1->info > ptr1->link->info)
            {

                int tem = ptr1->info;
                ptr1->info = ptr1->link->info;
                ptr1->link->info = tem;
                    swapped = 1;
            }
            ptr1 = ptr1->link;
        }
        lptr = ptr1;
    } while (swapped);
}
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 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;
```

```
}

NODE delete_front(NODE first)
{
        NODE temp;
        if(first==NULL)
        {
                printf("list is empty \n");
                return first;
        }

        temp=first->link;
        printf("deleted item at front = %d\n ",first->info);
        free(first);
        return temp;
}

NODE delete_rear(NODE first)
{
        NODE cur,prev;
        if(first==NULL)
        {
                printf("list is empty \n");
                return first;
        }
        if(first->link==NULL)
        {
                printf("only one item in list and delete item  = %d ",first->info);
           free(first);
                return NULL;
        }
        prev=NULL;
        cur=first;
        while(cur->link!=NULL)
        {
                prev=cur;
                cur=cur->link;
        }
        printf("deleted item at rear = %d \n ",cur->info);
        free(cur);
        prev->link=NULL;
        return first;
}


void main()
{
int item,choice,ch,n;
NODE first=NULL,a,b;
NODE stack_first=NULL,queue_first=NULL;
for(;;)
{
        printf("1.insert_rear\n2.sorting\n3.display list \n4.concatenating 2
lists \n5.reversing list \n6.stack implementation\n7.queue
implementation\n8.exit\n");
        printf("enter choice\n");
        scanf("%d",&choice);
switch(choice)
 {
  case 1:printf("Enter the item\n");
         scanf("%d",&item);
         first=insert_rear(first,item);
         break;

         case 2:sort(first);
         display(first);
   break;
  case 3:display(first);
         break;
  case 4:printf("Enter the no of nodes in 1\n");
                 scanf("%d",&n);
                 a=NULL;
                 for(int i=0;i<n;i++)
                  {
                   printf("Enter the item\n");
                   scanf("%d",&item);
                   a=insert_rear(a,item);
                  }
                  printf("Enter the no of nodes in 2\n");
                 scanf("%d",&n);
```

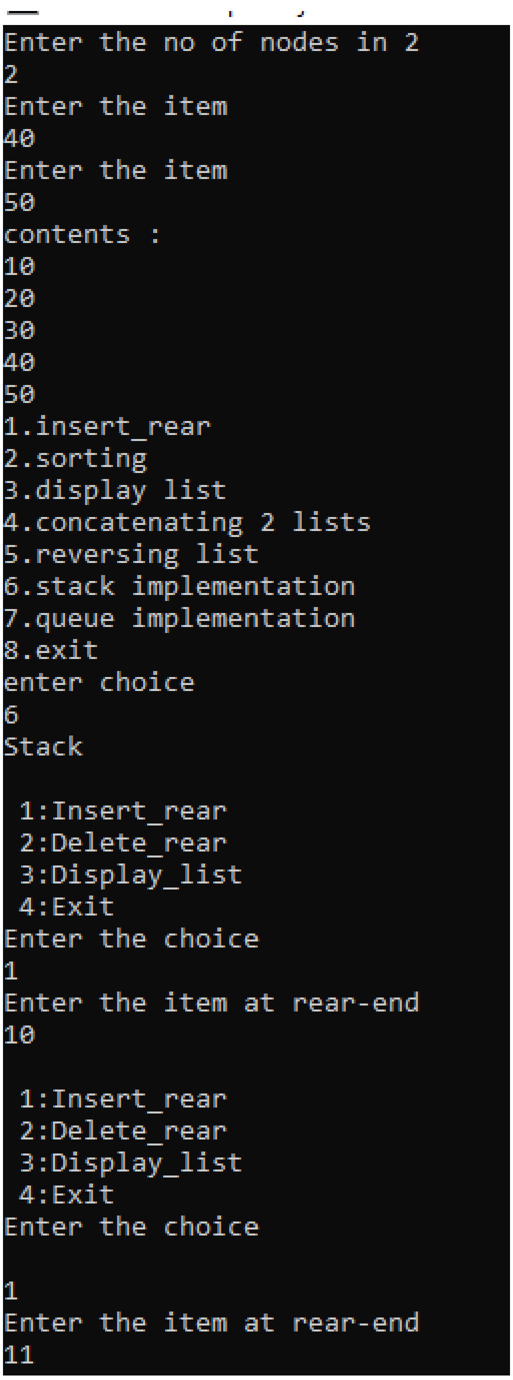
```
            b=NULL;
            for(int i=0;i<n;i++)
             {
              printf("Enter the item\n");
              scanf("%d",&item);
              b=insert_rear(b,item);
             }
             a=concat(a,b);
             display(a);
            break;
  case 5:first=reverse(first);
            display(first);
            break;
  case 6:printf("Stack\n");
for(;;)
{
printf("\n 1:Insert_rear\n 2:Delete_rear\n 3:Display_list\n 4:Exit\n");
printf("Enter the choice\n");
scanf("%d",&ch);
switch(ch)
{
case 1:printf("Enter the item at rear-end\n");
scanf("%d",&item);
first=insert_rear(first,item);
break;
case 2:first=delete_rear(first);
break;
case 3:display(first);
break;
default:ch=0;
}
if(ch==0)
      break;
}
break;
      case 7:     printf("QUEUE\n");
for(;;)
{
printf("\n 1:Insert_rear\n 2:Delete_front\n 3:Display_list\n 4:Exit\n");
printf("Enter the choice\n");
scanf("%d",&ch);
switch(ch)
{
case 1:printf("Enter the item at rear-end\n");
scanf("%d",&item);
first=insert_rear(first,item);
break;
case 2:first=delete_front(first);
break;
case 3:display(first);
break;
default:ch=0;
}
if(ch==0)
        break;
}
          break;
         default:exit(0);
 }
}
getch();
}
```



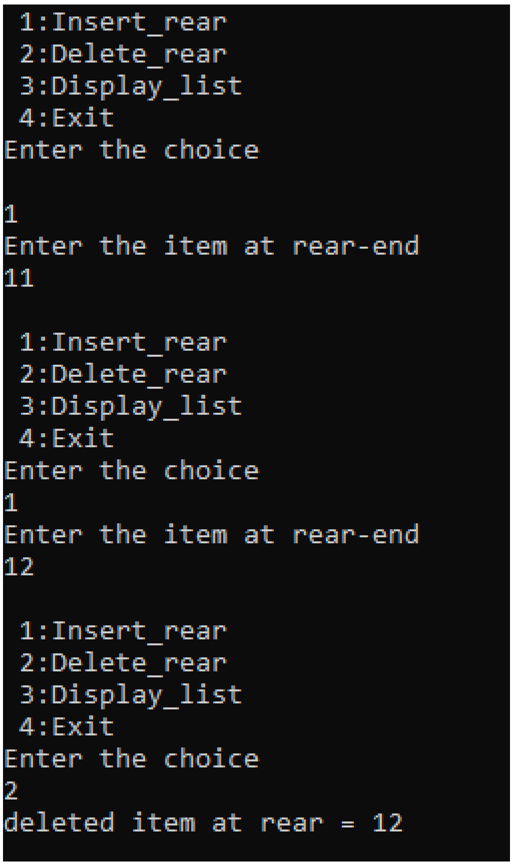
```
C:\Users\Prashanth\Documents\ds lab>gcc -o c

C:\Users\Prashanth\Documents\ds lab>obj
1.insert_rear
2.sorting
3.display list
4.concatenating 2 lists
5.reversing list
6.stack implementation
7.queue implementation
8.exit
enter choice
1
Enter the item
10
1.insert_rear
2.sorting
3.display list
4.concatenating 2 lists
5.reversing list
6.stack implementation
7.queue implementation
8.exit
enter choice
1
Enter the item
100
1.insert_rear
2.sorting
3.display list
4.concatenating 2 lists
5.reversing list
6.stack implementation
7.queue implementation
8.exit
enter choice
1
Enter the item
50
```



```
1.insert_rear
2.sorting
3.display list
4.concatenating 2 lists
5.reversing list
6.stack implementation
7.queue implementation
8.exit
enter choice
2
contents :
10
50
100
1.insert_rear
2.sorting
3.display list
4.concatenating 2 lists
5.reversing list
6.stack implementation
7.queue implementation
8.exit
enter choice
5
contents :
100
50
10
1.insert_rear
2.sorting
3.display list
4.concatenating 2 lists
5.reversing list
6.stack implementation
7.queue implementation
8.exit
enter choice
4
Enter the no of nodes in 1
3
Enter the item
10 20 30
```



```
Enter the no of nodes in 2
2
Enter the item
40
Enter the item
50
contents :
10
20
30
40
50
1.insert_rear
2.sorting
3.display list
4.concatenating 2 lists
5.reversing list
6.stack implementation
7.queue implementation
8.exit
enter choice
6
Stack

 1:Insert_rear
 2:Delete_rear
 3:Display_list
 4:Exit
Enter the choice
1
Enter the item at rear-end
10

 1:Insert_rear
 2:Delete_rear
 3:Display_list
 4:Exit
Enter the choice

1
Enter the item at rear-end
11
```



```
 1:Insert_rear
 2:Delete_rear
 3:Display_list
 4:Exit
Enter the choice

1
Enter the item at rear-end
11

 1:Insert_rear
 2:Delete_rear
 3:Display_list
 4:Exit
Enter the choice
1
Enter the item at rear-end
12

 1:Insert_rear
 2:Delete_rear
 3:Display_list
 4:Exit
Enter the choice
2
deleted item at rear = 12
```

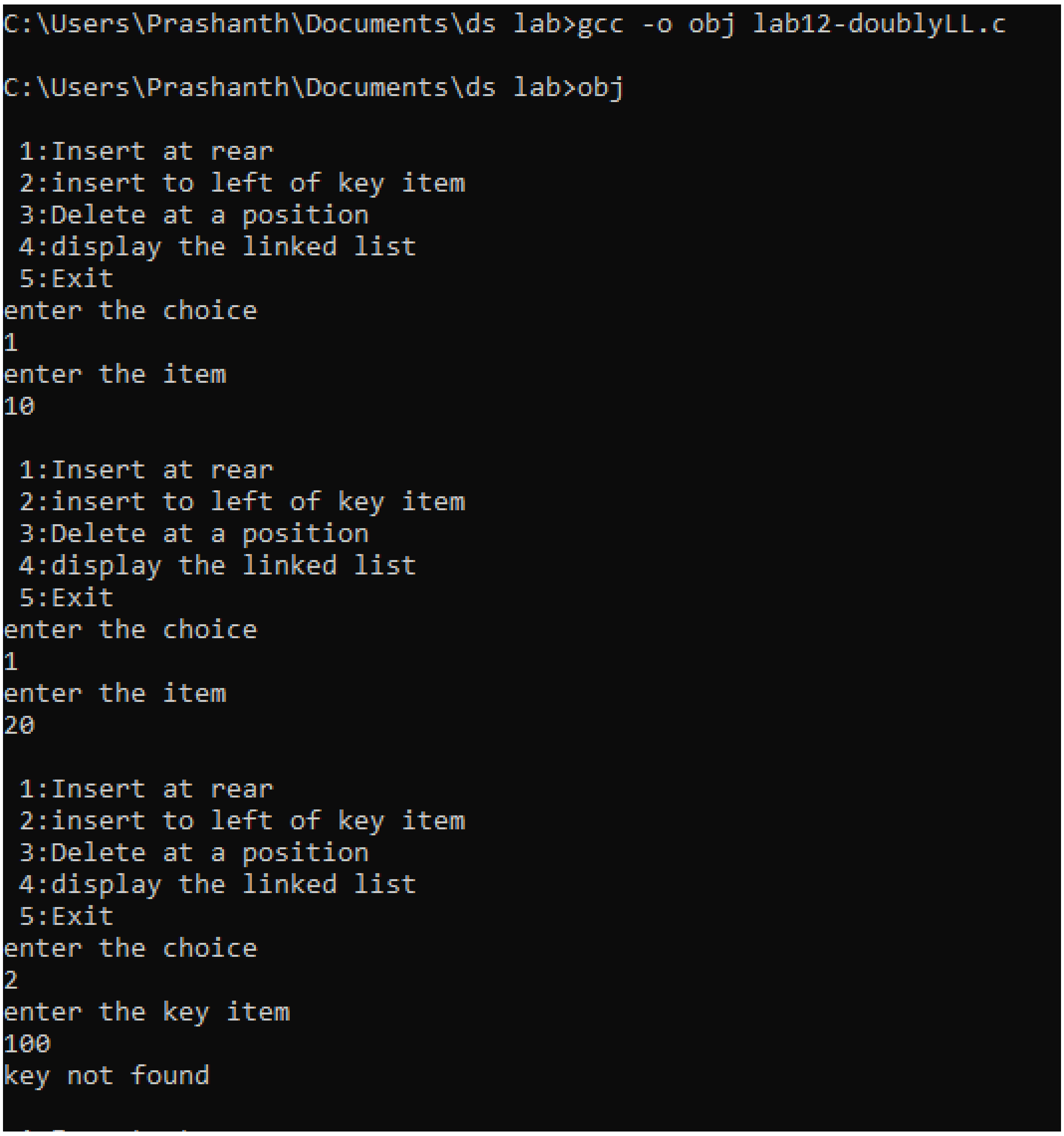
Lab Program 9:

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

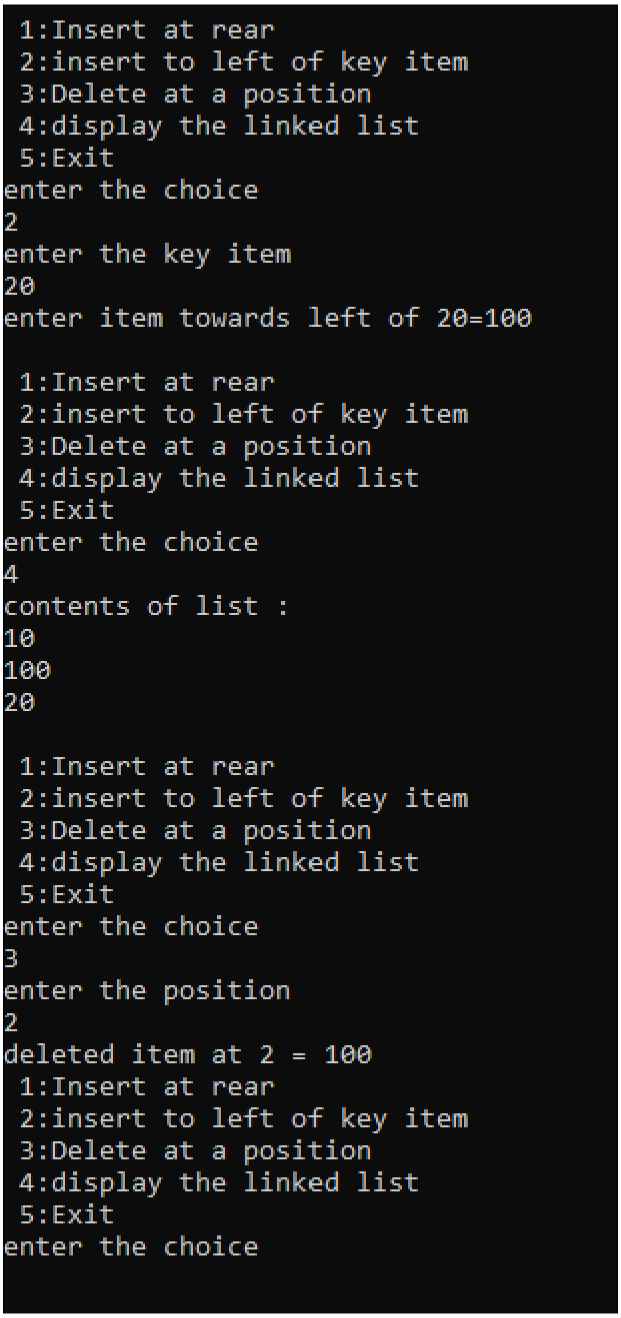
```
/*doubly linked list inserting at end , deleting at a position and display */
#include<stdio.h>
#include<conio.h>
#include<malloc.h>
#include<process.h>
struct node
{
  int info;
  struct node *llink;
  struct node *rlink;
};
typedef struct node *NODE;
NODE getnode()
{
NODE x;
x=(NODE)malloc(sizeof(struct node));
if(x==NULL)
```

```
 {
  printf("mem full\n");
  exit(0);
 }
 return x;
}

NODE insert_rear(int item,NODE head)
{
          NODE temp,cur;
          temp=getnode();
          temp->info=item;
          cur=head->llink;
          head->llink=temp;
          temp->rlink=head;
          temp->llink=cur;
          cur->rlink=temp;
          return head;
}

NODE insert_leftpos(int item,NODE head)
{
NODE temp,cur,prev;
if(head->rlink==head)
{
printf("list empty\n");
return head;
}
cur=head->rlink;
while(cur!=head)
{
if(item==cur->info)break;
cur=cur->rlink;
}
if(cur==head)
{
 printf("key not found\n");
 return head;
 }
 prev=cur->llink;
 printf("enter item towards left of %d=",item);
 temp=getnode();
 scanf("%d",&temp->info);
 prev->rlink=temp;
 temp->llink=prev;
 cur->llink=temp;
 temp->rlink=cur;
 return head;
}

NODE delete_position(int pos,NODE head)
{
	NODE p,q;
	int c=0;
	if(head==NULL)
	{
		printf("empty list \n");
		return head;
	}
	p=head;
	while((p->rlink!=NULL)&&(c!=pos))
	{
		q=p;
		p=p->rlink;
		c++;
	}
	if(c==pos)
	{
		printf("deleted item at %d = %d ",pos,p->info);
		q->rlink=p->rlink;
		if(p->rlink!=NULL)
			(p->rlink)->llink=q;
		free(p);
	}
	else
		printf("invalid position \n");
	return head;
}

void display(NODE head)
```

```
{
        if(head->rlink==head)
        {
                printf("empty list \n");
        }
        printf("contents of list : \n");
        NODE temp;
        temp=head->rlink;
        while(temp!=head)
        {
                printf("%d\n",temp->info);
                temp=temp->rlink;
        }
}

void main()
{
        NODE head;
int item, choice,pos;
head=getnode();
head->rlink=head;
head->llink=head;
for(;;)
{
printf("\n 1:Insert at rear\n 2:insert to left of key item \n 3:Delete at a
position\n 4:display the linked list \n 5:Exit\n");
printf("enter the choice\n");
scanf("%d",&choice);
switch(choice)
 {
  case 1:printf("enter the item \n");
         scanf("%d",&item);
         head=insert_rear(item,head);
         break;

  case 2:printf("enter the key item \n");
         scanf("%d",&item);
         head=insert_leftpos(item,head);
         break;
  case 3:printf("enter the position\n");
                    scanf("%d",&pos);
                    head=delete_position(pos,head);
                    break;
  case 4:display(head);
           break;
 default:exit(0);

 }
}
getch();
}
```



```
C:\Users\Prashanth\Documents\ds lab>gcc -o obj lab12-doublyLL.c

C:\Users\Prashanth\Documents\ds lab>obj

 1:Insert at rear
 2:insert to left of key item
 3:Delete at a position
 4:display the linked list
 5:Exit
enter the choice
1
enter the item
10

 1:Insert at rear
 2:insert to left of key item
 3:Delete at a position
 4:display the linked list
 5:Exit
enter the choice
1
enter the item
20

 1:Insert at rear
 2:insert to left of key item
 3:Delete at a position
 4:display the linked list
 5:Exit
enter the choice
2
enter the key item
100
key not found
```



```
 1:Insert at rear
 2:insert to left of key item
 3:Delete at a position
 4:display the linked list
 5:Exit
enter the choice
2
enter the key item
20
enter item towards left of 20=100

 1:Insert at rear
 2:insert to left of key item
 3:Delete at a position
 4:display the linked list
 5:Exit
enter the choice
4
contents of list :
10
100
20

 1:Insert at rear
 2:insert to left of key item
 3:Delete at a position
 4:display the linked list
 5:Exit
enter the choice
3
enter the position
2
deleted item at 2 = 100
 1:Insert at rear
 2:insert to left of key item
 3:Delete at a position
 4:display the linked list
 5:Exit
enter the choice
```

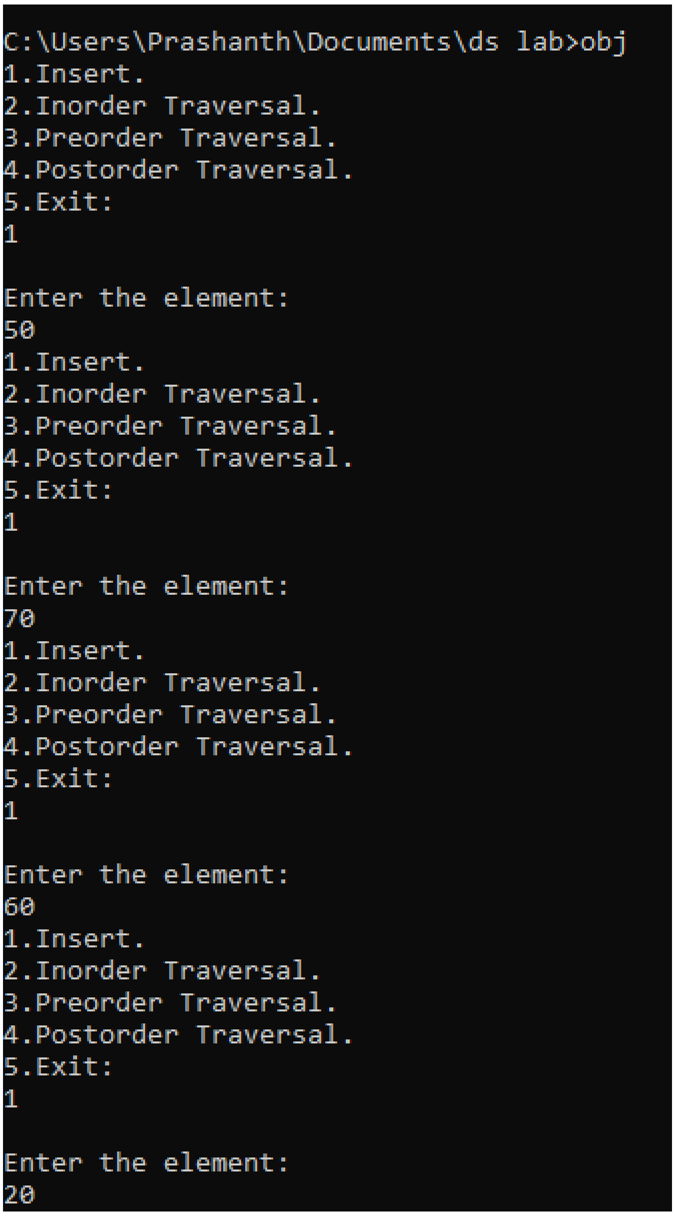
Lab Program 10:

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.

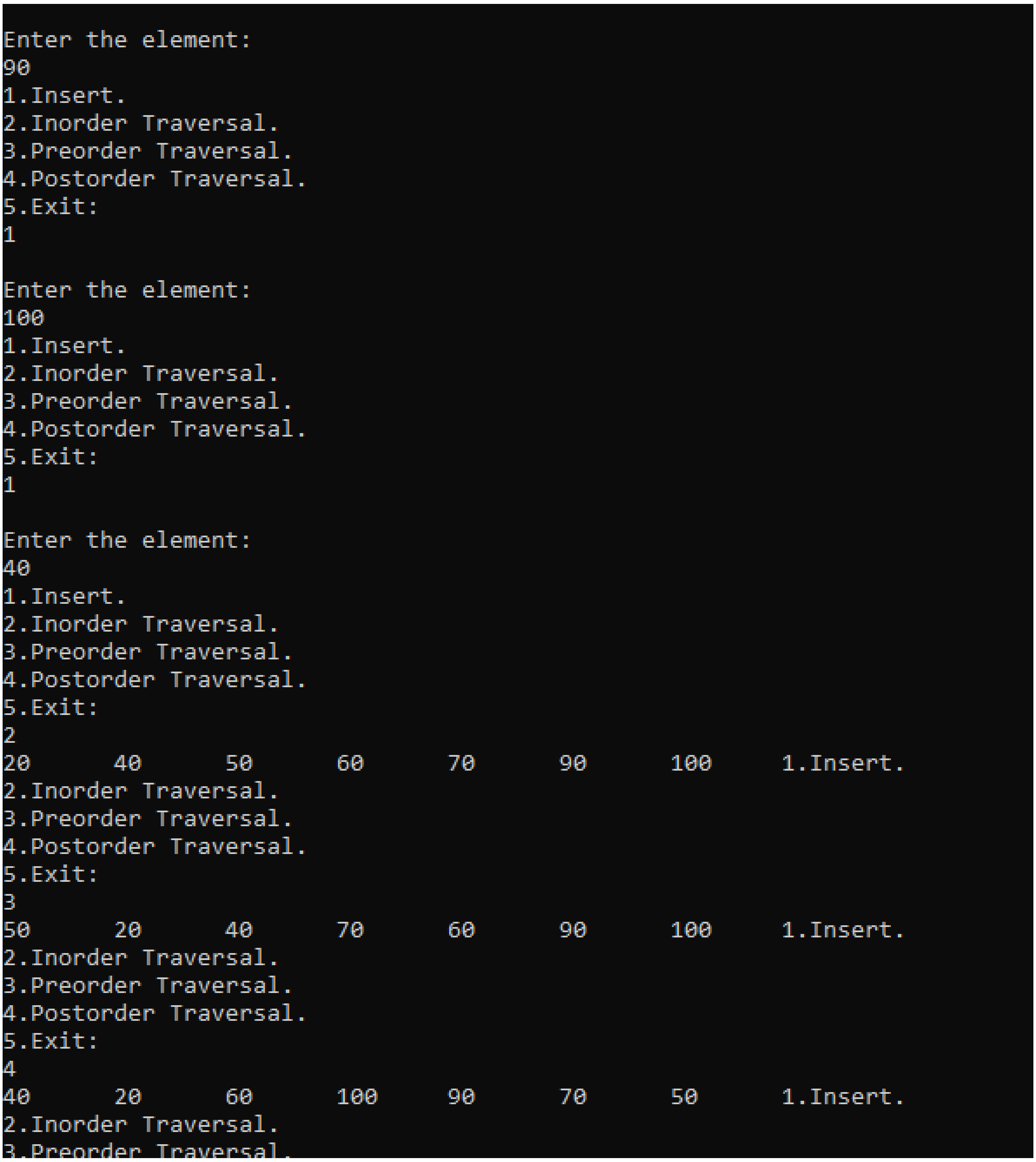
```
/*a) To construct a binary Search tree.
b) To traverse the tree using all the methods i.e., in-order, preorder and
post order
c) To display the elements in the tree.*/

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

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

NODE getnode(int item)
 {
    NODE x = (NODE)malloc(sizeof(struct node));
    if(x!=NULL){
           x->data=item;
           x->left = NULL;
           x->right = NULL;
           return x;
           }
    else {
        printf("Memory allocation failed!\n");
        exit(0);
    }
}
NODE insert(NODE root,int item)
{
           if(root ==NULL)
                      return getnode(item);
           if(item<root->data)
                      root->left = insert(root->left,item);
           else if(item>root->data)
                      root->right = insert(root->right,item);
           return root;
}
void inorder(NODE root)
{
           if(root == NULL)
           return;
           inorder(root->left);
           printf("%d\t",root->data);
           inorder(root->right);
}
void preorder(NODE root)
```

```
{
        if(root == NULL)
        return;
        printf("%d\t",root->data);
        preorder(root->left);
        preorder(root->right);
}
void postorder(NODE root)
{
        if(root == NULL)
        return;
        postorder(root->left);
        postorder(root->right);
        printf("%d\t",root->data);
}
int main()
{
        NODE root = NULL;
        int item,ch;
        for(;;)
        {
        printf("1.Insert.\n2.Inorder Traversal.\n3.Preorder
Traversal.\n4.Postorder Traversal.\n5.Exit:\n");
        scanf("%d",&ch);
        switch(ch){
                case 1: printf("\nEnter the element:\n");
                        scanf("%d",&item);
                        root = insert(root,item);
                        break;
                case 2: inorder(root);
                        break;
                case 3: preorder(root);
                        break;
                case 4: postorder(root);
                        break;
                case 5: exit(1);
                default :printf("Invalid Choice");
                }
        }
}
```



```
C:\Users\Prashanth\Documents\ds lab>obj
1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
1

Enter the element:
50
1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
1

Enter the element:
70
1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
1

Enter the element:
60
1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
1

Enter the element:
20
```



```
Enter the element:
90
1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
1

Enter the element:
100
1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
1

Enter the element:
40
1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
2
20      40      50      60      70      90      100     1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
3
50      20      40      70      60      90      100     1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
4.Postorder Traversal.
5.Exit:
4
40      20      60      100     90      70      50      1.Insert.
2.Inorder Traversal.
3.Preorder Traversal.
```