



JAGAT GURU NANAK DEV PUNJAB STATE OPEN UNIVERSITY, PATIALA

(Established by Act No. 19 of 2019 of the Legislature of State of Punjab)

The Motto of the University (SEWA)

SKILL ENHANCEMENT

**EMPLOYABILITY
ACCESSIBILITY**

WISDOM



DIPLOMA IN SOFTWARE DEVELOPMENT AND PROGRAMMING SEMESTER-II

Course: Data Structures Lab

Course Code: DSDP-2-02P

ADDRESS: C/28, THE LOWER MALL, PATIALA-147001

WEBSITE: www.psou.ac.in

DSDP-2-02P: Data Structures Lab

Total Marks: 50
External Marks: 35
Internal Marks: 15
Credits: 2
Pass Percentage: 40%

Course: Data Structures Lab	
Course Code: DSDP-2-02P	
Course Outcomes (COs)	
After the completion of this course, the students will be able to:	
CO1	Implement basic data structures such as arrays and linked list.
CO2	Develop programs to demonstrate fundamental algorithmic problems including Tree Traversals and Graph traversals.
CO3	Implement various searching and sorting algorithms.
CO4	Develop programs to demonstrate the implementation of various operations on stack
CO5	Develop programs to demonstrate the implementation of various operations on queue

Detailed List of Programmes:

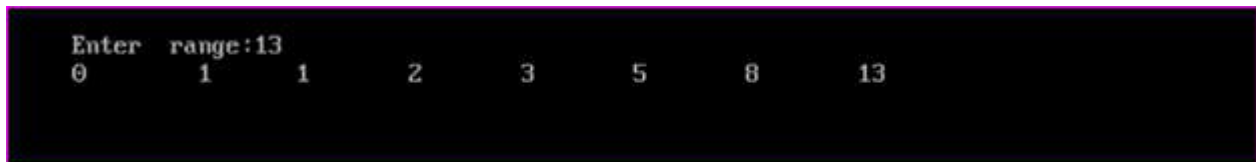
Programme No.	Name of Programme
P1	WAP to demonstrate the concept of one dimensional array finding the sum of array elements.
P2	WAP to insert an element in an array
P3	WAP to delete an element from an array.
P4	WAP to insert an element at the beginning of a linked list
P5	WAP to insert an element at the end of a linked list
P6	WAP to insert an element within the linked list
P7	WAP to demonstrate PUSH and POP operations of stack using array
P8	WAP to demonstrate the implementation of queue using linked list
P9	WAP to search an element from an linear array using linear search.
P10	WAP to Search an element using binary search.
P11	WAP to arrange the list of numbers in ascending order using Bubble Sort.
P12	WAP to arrange the list of numbers in ascending order using Insertion Sort.
P13	WAP to arrange the list of numbers in ascending order using Selection Sort.

P14	WAP to demonstrate the operation of Pre order Traversing technique of Tree
	WAP to demonstrate the operation of Post order Traversing technique of Tree
P15	WAP to implement a simple Depth-First Search (DFS) traversal in Graph .
P16	WAP to implement a simple Breadth-First Search (BFS) traversal in Graph.

1. Aim: To display Fibonacci series up to a range.

```
#include<stdio.h>
#include<conio.h>
void main()
{
int a,b,c,n;
clrscr();
printf("\n Enter range:");
scanf("%d",&n);
a=0,b=1,c=0;
printf("%d \t %d",a,b);
c=a+b;
while(c<=n)
{
printf("\t%d",c);
a=b;
b=c;
c=a+b;
}
getch();
}
```

Output:



```
Enter range:13
0      1      1      2      3      5      8      13
```

2. Aim: To read n numbers and display it.

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

void main()
{
int i,n, a[10];
clrscr();
printf("\nEnter the number of element : \n");
scanf("%d",&n);
printf("Enter element: \n");
for(i=0;i<n;i++)
{
printf("a[%d]=",i);
```

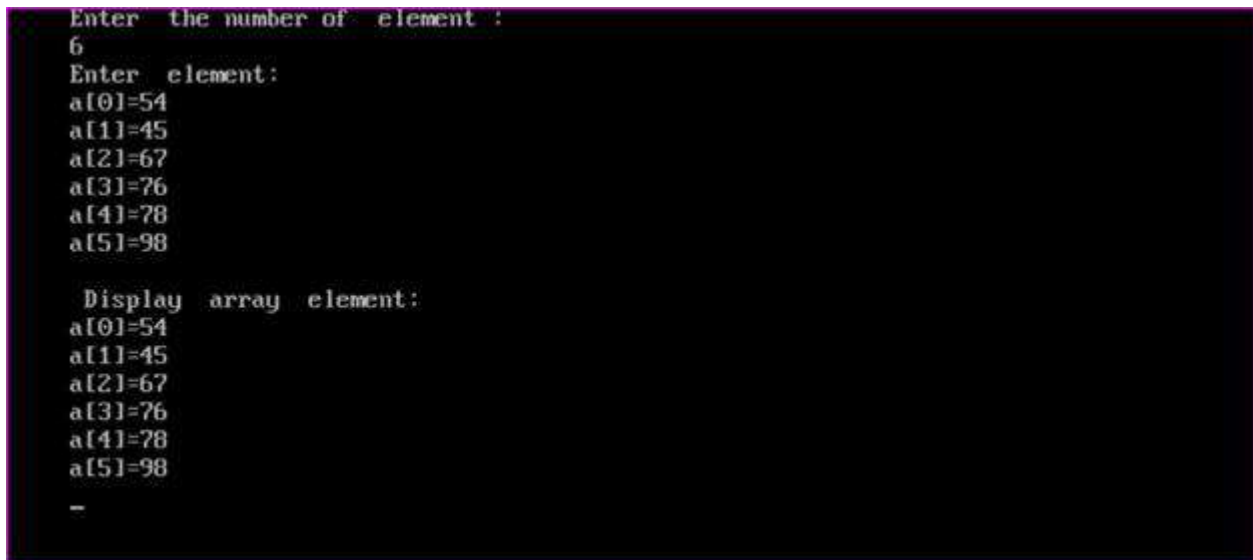
```

scanf("%d",&a[i]);
}
printf("\n Display array element: \n");
for(i=0;i<n;i++)
{
printf("a[%d]=%d\n",i,a[i]);

}
getch();
}

```

Output:



```

Enter the number of element :
6
Enter element:
a[0]=54
a[1]=45
a[2]=67
a[3]=76
a[4]=78
a[5]=98

Display array element:
a[0]=54
a[1]=45
a[2]=67
a[3]=76
a[4]=78
a[5]=98
-

```

3. Aim: To demonstrate the concept of one dimensional array finding the sum of array elements.

```

#include<stdio.h>
#include<conio.h>

void main()
{
int i,n, a[10],s;
clrscr();
printf("Enter the number of element : \n");
scanf("%d",&n);
s=0;
printf("Enter element: \n");
for(i=0;i<n;i++)

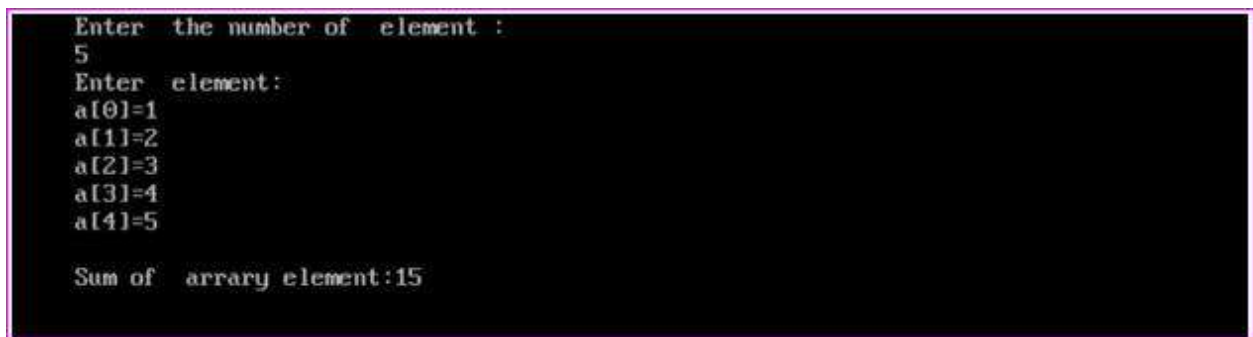
```

```

{
printf("a[%d]=",i);
scanf("%d",&a[i]);
s=s+a[i];
}
printf("Sum of array element:%d",s);
getch();
}

```

Output:



```

Enter the number of element :
5
Enter element:
a[0]=1
a[1]=2
a[2]=3
a[3]=4
a[4]=5

Sum of array element:15

```

4. Aim: To insert an element in an array.

```

#include<stdio.h>
#include<conio.h>
{
int i,n,pos,num, a[10];
clrscr();
printf("Enter the number of element :\n");
scanf("%d",&n);
printf("Enter element:\n");
for(i=0;i<n;i++)
{
printf("a[%d]=",i);
scanf("%d",&a[i]);
}
printf("\nEnter the pos where the no. is to be inserted :");
scanf("%d",&pos);
printf("\nEnter the the no. is to be inserted :");
scanf("%d",&num);
for(i=n-1;i>=pos;i--)
{
a[i+1]=a[i];
n=n+1;
a[pos]=num;
}
}

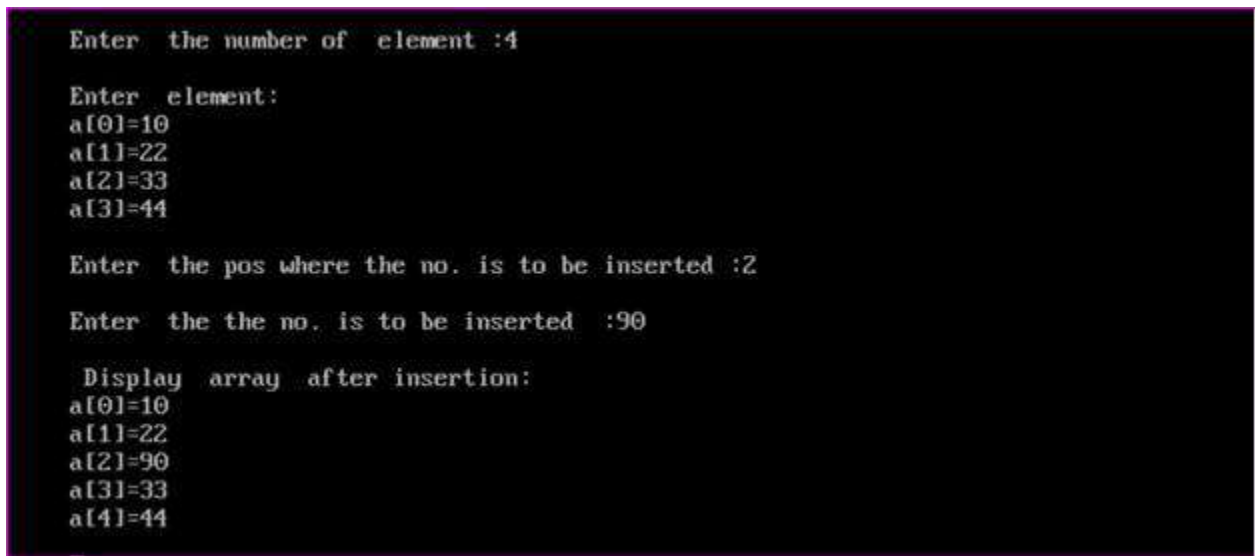
```

```

printf("\n Display array after insertion:\n");
for(i=0;i<n;i++)
{
printf("a[%d]=%d\n",i,a[i]);
}
getch();
}

```

Output:



```

Enter the number of element :4

Enter element:
a[0]=10
a[1]=22
a[2]=33
a[3]=44

Enter the pos where the no. is to be inserted :2

Enter the the no. is to be inserted :90

Display array after insertion:
a[0]=10
a[1]=22
a[2]=90
a[3]=33
a[4]=44

```

5. To delete an element from an array.

```

#include<stdio.h>
#include<conio.h>
void main()
{
int i,n,pos, a[10];
clrscr();
printf("Enter the number of elements :\n");
scanf("%d",&n);
printf("Enter element: \n ");
for(i=0;i<n;i++)
{
printf("a[%d]=",i);
scanf("%d",&a[i]);
}
printf("\nEnter the pos from which the no. has to be deleted :");
scanf("%d",&pos);
for(i=pos;i<n;i++)

```

```

a[i]=a[i+1];
n=n-1;
printf("\n Displar array after deletion: \n ");
for(i=0;i<n;i++)
{
printf("\n a[%d]=%d",i,a[i]);
}
getch();
}

```

Output:

```

Enter the number of elements :7
Enter element:a[0]=12
a[1]=23
a[2]=43
a[3]=25
a[4]=78
a[5]=45
a[6]=14

Enter the pos from which the no. has to be deleted :4

Displar array after deletion:
a[0]=12
a[1]=23
a[2]=43
a[3]=25
a[4]=45
a[5]=14

```

6. Aim: Implementation of linked list using array.

```

#include<stdio.h>
#include<conio.h>
#define TRUE 1
#define SIZE 10
struct link
{
int info;
int next;
};
struct link node[SIZE];

int Getnode();
void Createlist();
void Freenode(int);
void Display();
void Insert(int,int);

```



```

void Delete(int);
int p, avail=0;
void main()
{
    int ch=1,i,n,x;
    clrscr();
    /*Creation of available list*/
    for(i=0;i<SIZE-1;i++)
        node[i].next=i+1;
    node[SIZE-1].next=-1;
    printf("\n Create a List:");
    Createlist();
    while(ch!=4)
    {
        printf("\n1-DISPLAY");
        printf("\n2-INSERT");
        printf("\n3-DELETE");
        printf("\n4-QUIT");
        printf("\n Enter your choice:");
        scanf("%d",&ch);
        switch(ch)
        {
            case 1 :
                Display();
                break;
            case 2:
                printf("\n Node insertion:after which node:");
                scanf("%d",&n);
                p=n;
                printf("\n Enter the item for insertion:");
                scanf("%d",&x);
                Insert(p,x);
                break;
            case 3:
                printf("\n Enter the node after which the node will be deleted:");
                scanf("%d",&n);
                p=n;
                Delete(p);
                break;
            case 4:
                break;
            default:
                printf("\n Wrong choice!Try again:");
        }
    }
}

int Getnode()
{

```

```

if (avail== -1)
{
printf("\n Overflow:");
exit(0);
}
p=avail;
avail=node[avail].next;
return p;
}
void Freenode(int q)
{
node[q].next=avail;
avail=q;
return;
}
void Createlist()
{
int x;
char c;
p=Getnode();
printf("\n Enter an item to be inserted:");
scanf("%d", &x);
node[p].info=x ;
node[p].next=-1;
while(TRUE)
{
printf("\n Enter the choice(y/n):");
fflush(stdin);
c=getchar();
if(c=='y' || c=='Y')
{
printf("\n Enter an item to be inserted:");
scanf("%d",&x);
Insert(p,x);
node[p].next= -1;
}
else
return;
}
}
void Display()
{
p=0;
while(node[p].next!= -1)
{
printf("\n%d\t%d\t%d:",p,node[p].info,node[p].next);
p=node[p].next;
}
}

```

```

printf("\n%d\t%d\t%d:",p,node[p].info,node[p].next);
}
void Insert(int r,int x)
{
int q;
if(r==-1)
{
printf("\n void insertion:");
return;
}
q=Getnode();
node[q].info=x;
node[q].next=node[r].next;
node[r].next=q;
return;
}
void Delete(int r)
{
int q;
if(r==-1||node[r].next==-1)
{
printf("\n void deletion:");
return;
}
q=node[r].next;
node[r].next=node[q].next;
Freenode(q);
return;
}

```

Output:

```
Enter an item to be inserted:4
Enter the choice(y/n):y
Enter an item to be inserted:23
Enter the choice(y/n):y
Enter an item to be inserted:87
Enter the choice(y/n):y
Enter an item to be inserted:22
Enter the choice(y/n):y
Enter an item to be inserted:12
Enter the choice(y/n):n
1-DISPLAY
2-INSERT
3-DELETE
4-QUIT
Enter your choice: _
```

```
Enter your choice:2
Node insertion:after which node:3
Enter the item for insertion:99
1-DISPLAY
2-INSERT
3-DELETE
4-QUIT
Enter your choice:1
0      4      1:
1      23     2:
2      87     3:
3      22     5:
5      99     4:
4      12     -1:
1-DISPLAY
2-INSERT
3-DELETE
4-QUIT
Enter your choice:3
Enter the node after which the node will be deleted: _
```

```

4      12      -1:
1-DISPLAY
2-INSERT
3-DELETE
4-QUIT
Enter your choice:3

Enter the node after which the node will be deleted:1

1-DISPLAY
2-INSERT
3-DELETE
4-QUIT
Enter your choice:1

0      4      1:
1      23     3:
3      22     5:
5      99     4:
4      12     -1:
1-DISPLAY
2-INSERT
3-DELETE
4-QUIT
Enter your choice:4

```

7. Aim: Implementation of stack using array.

```

#include<stdio.h>
#include<conio.h>
#include<stdlib.h>
#define MAXSTK 100
int top=-1;
int items[MAXSTK];
int Iseempty();
int Isfull();
void Push(int);
int Pop();
void Display();
void main()
{
int x;
char ch='1';
clrscr();
while(ch!='4')
{
printf("\n 1-PUSH");

```

```

printf("\n 2-POP");
printf("\n 3-DISPLAY");
printf("\n 4-QUIT");
printf("\n Enter your choice:");
fflush(stdin);
ch=getchar();
switch(ch)
{
case '1':
printf("\n Enter the element to be pushed:");
scanf("%d",&x);
Push(x);
break;
case '2':
x=Pop();
printf("\n Pop element is %d\n:",x);
break;
case '3':
Display();
break;
case '4':
break;
default:
printf("\n Wrong choice!Try again:");
}
}
}
int Iseempty()
{
if(top==-1)
return 1;
else
return 0;
}
int Isfull()
{
if(top==MAXSTK-1)
return 1;
else
return 0;
}
void Push(int x)
{
if(Isfull())
{
printf("\n Stack full");
return;
}
}

```

```
}
top++;
items[top]=x;
}
int Pop()
{
int x;
if(Isempty())
{
printf("\n Stack empty");
exit(0);
}
x=items[top];
top--;
return x;
}
void Display()
{
int i;
if(Isempty())
{
printf("\n Stack empty");
return;
}
printf("\n Elements in the Stack are :\n");
for(i=top;i>=0;i--)
printf("%d\n",items[i]);
}
```

Output:

Enter the element to be pushed:78

1-PUSH

2-POP

3-DISPLAY

4-QUIT

Enter your choice:1

Enter the element to be pushed:87

1-PUSH

2-POP

3-DISPLAY

4-QUIT

Enter your choice:3

Elements in the Stack are :

87

78

1-PUSH

2-POP

3-DISPLAY

4-QUIT

Enter your choice:_

87

78

1-PUSH

2-POP

3-DISPLAY

4-QUIT

Enter your choice:2

Pop element is 87

:

1-PUSH

2-POP

3-DISPLAY

4-QUIT

Enter your choice:3

Elements in the Stack are :

78

1-PUSH

2-POP

3-DISPLAY

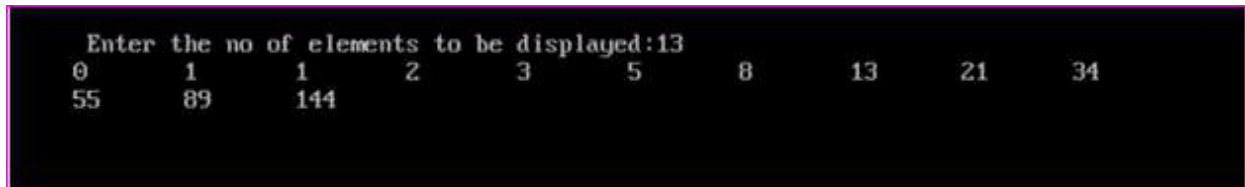
4-QUIT

Enter your choice:4_

8. Aim: To Create Fibonacci series using recursive function.

```
#include<stdio.h>
#include<conio.h>
int Fibonacci(int);
void main()
{
    int i,n;
    clrscr();
    printf("\n Enter the no of elements to be displayed:");
    scanf("%d",&n);
    for(i=0;i<n;i++)
        printf("%d\t",Fibonacci(i));
    getch();
}
int Fibonacci(int n)
{
    if(n<=0)
        return 0;
    else if (n==1)
        return 1;
    else
        return Fibonacci(n-1)+ Fibonacci(n-2);
}
```

Output:



```
Enter the no of elements to be displayed:13
0      1      1      2      3      5      8      13      21      34
55     89     144
```

9. Aim: Calculate factorial of a number using recursive function.

```
#include<stdio.h>
#include<conio.h>
int Factorial(int);
void main()
{
    int i,n;
    clrscr();
    printf("\n Enter the no of elements:");
```

```

scanf("%d",&n);
printf("Factorial of %d is %d",n,Factorial(n));
getch();
}
int Factorial(int n)
{
if(n==0)
return 1;
else
return n*Factorial(n-1);
}

```

Output:



```

Enter the no of elements:5
Factorial of 5 is 120

```

10. Aim: Implementation of queue using array.

```

#include<stdio.h>
#include<conio.h>
#include<stdlib.h>
#define MAXQ 100
int front=0,rear=-1;
int items[MAXQ];
int Iseempty();
int Isfull();
void Insert(int);
int Delete();
void Display();
void main()
{
int x;
char ch='1';
clrscr();
while(ch!='4')
{
printf("\n 1-INSERT");
printf("\n 2-DELETE");
printf("\n 3-DISPLAY");
printf("\n 4-QUIT");
printf("\n Enter your choice:");
fflush(stdin);
ch=getchar();
}
}

```

```

switch(ch)
{
case '1':
printf("\n Enter the element to be inserted:");
scanf("%d",&x);
Insert(x);
break;
case '2':
x=Delete();
printf("\n Delete element is %d\n:",x);
break;
case '3':
Display();
break;
case '4':
break;
default:
printf("\n Wrong choice!Try again:");
}
}
getch();
}
int Iseempty()
{
if(rear<front)
return 1;
else
return 0;
}
int Isfull()
{
if(rear==MAXQ-1)
return 1;
else
return 0;
}
void Insert(int x)
{
if(Isfull())
{
printf("\n Queue full");
return;
}
rear++;
items[rear]=x;
}
int Delete()
{

```

```
int x;
if(Isempty())
{
printf("\n Queue is empty");
exit(0);
}
x=items[front];
front++;
return x;
}
void Display()
{
int i;
if(Isempty())
{
printf("\n Queue is empty");
return;
}
printf("\n Elements in the Queue are :\n");
for(i=front;i<=rear;i++)
printf("%d\n",items[i]);
}
```

Output:

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:1

Enter the element to be inserted:30

1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:1

Enter the element to be inserted:40

1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:1

Enter the element to be inserted:50_
```

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:3

Elements in the Queue are :
30
40
50

1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:2

Delete element is 30
:
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:
```

```

50

1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:2

Delete element is 30
:
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:3

Elements in the Queue are :
40
50

1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:4

```

11. Aim: Implementation of circular queue using array.

```

#include<stdio.h>
#include<conio.h>
#include<stdlib.h>
#define MAXQ 100
int front=-1,rear=-1;
int items[MAXQ];
int Iseempty();
int Isfull();
void Insert(int);
int Delete();
void Display();
void main()
{
int x;
char ch='1';
clrscr();
while(ch!='4')

```

```

{
printf("\n 1-INSERT");
printf("\n 2-DELETE");
printf("\n 3-DISPLAY");
printf("\n 4-QUIT");
printf("\n Enter your choice:");
fflush(stdin);
ch=getchar();
switch(ch)
{
case '1':
printf("\n Enter the nos of element to be inserted:");
scanf("%d",&x);
Insert(x);
break;
case '2':
x=Delete();
printf("\n Deleted element is %d\n",x);
break;
case '3':
Display();
break;
case '4':
break;
default:
printf("\n Wrong choice!Try again:");
}
}
getch();
}
int Iseempty()
{
if(front==-1)
return 1;
else
return 0;
}
int Isfull()
{
if(front==(rear+1)%MAXQ)
return 1;
else
return 0;
}
void Insert(int x)
{
if(Isfull())

```

```

{
printf("\n Queue full");
return;
}
if (front==-1)
{
front=0;
rear=0;
}
else
rear=(rear+1)%MAXQ;
items[rear]=x;
}
int Delete()
{
int x;
if(Isempty())
{
printf("\n Queue is empty");
exit(0);
}
x=items[front];
if (front==rear)
{
front=-1;
rear=-1;
}
else
front=(front+1)%MAXQ;
return x;
}
void Display()
{
int i,n;
if(Isempty())
{
printf("\n Queue is empty");
return;
}
printf("\n Elements in the Queue are :\n");
if(front<=rear)
{
for(i=front;i<=rear;i++)
printf("%d\n",items[i]);
}
else
{

```



```
for(i=front;i<=MAXQ-1;i++)
printf("%d\n",items[i]);
for(i=0;i<=rear;i++)
printf("%d\n",items[i]);
}
}
```

Output:

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:1

Enter the nos of element to be inserted:20

1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:1

Enter the nos of element to be inserted:30

1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:1

Enter the nos of element to be inserted:40
```

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:1
```

```
Enter the nos of element to be inserted:50
```

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:3
```

```
Elements in the Queue are :
20
30
40
50
```

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:_
```

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:2
```

```
Deleted element is 20
:
```

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:3
```

```
Elements in the Queue are :
30
40
50
```

```
1-INSERT
2-DELETE
3-DISPLAY
4-QUIT
Enter your choice:
```

12. Aim: Implementation of binary search tree using array.

```
#include<stdio.h>
#include<conio.h>
#include<stdlib.h>
#define TRUE 1
#define TREENODES 100
#define FALSE 0
struct tree
{
int info;
int used;
};
struct tree node[TREENODES];
void Createtree();
void Insert(int);
void Display();
void Setleft(int,int);
void Setright(int,int);
void main()
{
int x;
char ch='1';
clrscr();
printf("\n Enter root node value:");
scanf("%d", &x);
Createtree(x);
while(ch!='3')
{
printf("\n1-INSERT");
printf("\n2-DISPLAY");
printf("\n3-QUIT");
printf("\n Enter your choice:");
fflush(stdin);
ch=getchar();
switch(ch)
{
case '1':
printf("\n Enter the element to be inserted:");
scanf("%d",&x);
Insert(x);
break;
case '2':
Display();
break;
```

```

case '3':
break;
default:
printf("\n Wrong choice!Try again:");
}
}}
void Createtree(int x)
{
int i;
node[0].info=x;
node[0].used=TRUE;
for(i=1;i<TREENODES;i++)
node[i].used=FALSE;
}
void Insert(int x)
{
int p,q;
p=q=0;
while(q<TREENODES && node[q].used && x!=node[p].info)
{
p=q;
if(x<node[p].info)
q=2*p+1;
else
q=2*p+2;
}
if(x==node[p].info)
printf("\n %d is a duplicate number\n",x);
else
if(x<node[p].info)
Setleft(p,x);
else
Setright(p,x);
}
void Setleft(int pos,int x)
{
int q;
q=2*pos+1;
if(q>TREENODES)
printf("\n Array overflow.");
else
if(node[q].used==TRUE)
printf("\n Invalid insertion.");
else
{
node[q].info=x;

```

```
node[q].used=TRUE;
}
}
void Setright(int pos,int x)
{
int q;
q=2*pos+2;
if(q>TREENODES)
printf("\n Array overflow.");
else
if(node[q].used==TRUE)
printf("\n Invalid insertion.\n");
else
{
node[q].info=x;
node[q].used=TRUE;
}
}
void Display()
{
int i;
for(i=0;i<TREENODES;i++)
if(node[i].used==TRUE)
printf("%d ",node[i].info);
printf("\n");
}
```

Output:

```
Enter root node value:60

1-INSERT
2-DISPLAY
3-QUIT
Enter your choice:1

Enter the element to be inserted:40

1-INSERT
2-DISPLAY
3-QUIT
Enter your choice:1

Enter the element to be inserted:30

1-INSERT
2-DISPLAY
3-QUIT
Enter your choice:1

Enter the element to be inserted:70

1-INSERT
2-DISPLAY
3-QUIT
Enter your choice:1

Enter the element to be inserted:70

1-INSERT
2-DISPLAY
3-QUIT
Enter your choice:1

Enter the element to be inserted:90

1-INSERT
2-DISPLAY
3-QUIT
Enter your choice:2
60 40 70 30 90

1-INSERT
2-DISPLAY
3-QUIT
Enter your choice:3_
```

13. Aim: To Search an element using sequential search.

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

int Sequentialsearch(int[],int,int);
void main()
{
int x[20],i,n,p,key;
clrscr();
printf("\n Enter the no of element:");
scanf("%d",&n);
printf("\n Enter %d elements:",n);
for(i=0;i<n;i++)
scanf("%d",&x[i]);
printf("\n Enter the element to be search:");
scanf("%d",&key);
p=Sequentialsearch(x,n,key);
if(p==-1)
printf("\n The searchis unsuccessful:\n");
else
printf("\n%d is found at location %d",key,p);
getch();
}

int Sequentialsearch(int a[],int n ,int k)
{
int i;
for(i=0;i<n;i++)
{
if(k==a[i])
return(i);
}
return(-1);
}
```

Output:

```
Enter the no of element:4

Enter 4 elements:34
89
90
24

Enter the element to be search:90

90 is found at location 2
```

14. Aim: To Search an element using binary search.

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

int Binarysearch(int[],int,int);
void main()
{
int x[20],i,n,p,key;
clrscr();
printf("\n Enter the no of element:");
scanf("%d",&n);
printf("\n Enter %d elements in assending order:",n);
for(i=0;i<n;i++)
scanf("%d",&x[i]);
printf("\n Enter the element to be search:");
scanf("%d",&key);
p=Binarysearch(x,n,key);
if(p== -1)
printf("\n The searchis unsuccessful:\n");
else
printf("\n%d is found at location %d",key,p);
```



```
getch();
}

int Binarysearch(int a[],int n ,int k)
{
int lo,hi,mid;
lo=0;
hi=n-1;
while(lo<=hi)
{
mid=(lo+hi)/2;
if(k==a[mid])
return(mid);
if(k<a[mid])
hi=mid-1;
else
lo=mid+1;
}
return(-1);
}
```

Output:

```
Enter the no of element:6

Enter 6 elements in assending order:34
56
67
84
89
90

Enter the element to be search:89

89 is found at location 4
```

15. Aim: Arrange the list of numbers in ascending order using Bubble Sort.

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

void Bubblesort(int[],int);
void main()
{
    int x[20],i,n;
    clrscr();
    printf("\n Enter the no of element to be sorted:");
    scanf("%d",&n);
    printf("\n Enter %d elements:",n);
    for(i=0;i<n;i++)
        scanf("%d",&x[i]);
    Bubblesort(x,n);
    printf("\n The sorted array is:\n");
    for(i=0;i<n;i++)
        printf("%4d",x[i]);
    getch();
}

void Bubblesort(int a[],int n)
{
    int temp,pass,i;
    for(pass=0;pass<n-1;pass++)
    {
        for(i=0;i<n-pass-1;i++)
        {
            if(a[i]>a[i+1])
            {
                temp=a[i];
                a[i]=a[i+1];
                a[i+1]=temp;
            }
        }
    }
}
```

Output:

```
Enter the no of element to be sorted:6
```

```
Enter 6 elements:12
```

```
90
```

```
76
```

```
45
```

```
13
```

```
7
```

```
The sorted array is:
```

```
7 12 13 45 76 90
```

16. Aim: Arrange the list of numbers in ascending order using Insertion Sort.

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

```
#include<conio.h>
```

```
void Insertionsort(int[],int);
```

```
void main()
```

```
{
```

```
int x[20],i,n;
```

```
clrscr();
```

```
printf("\n Enter the no of element to be sorted:");
```

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

```
printf("\n Enter %d elements:",n);
```

```
for(i=0;i<n;i++)
```

```
scanf("%d",&x[i]);
```

```
Insertionsort(x,n);
```

```
printf("\n The sorted array is:\n");
```

```
for(i=0;i<n;i++)
```

```
printf("%4d",x[i]);
```

```
getch();
```

```
}
```

```
void Insertionsort(int a[],int n)
```

```
{
int i,j,key;
for(j=1;j<n;j++)
{
key=a[j];
i=j-1;
while((i>-1)&&(a[i]>key))
{
a[i+1]=a[i];
i=i-1;
}
a[i+1]=key;
}
}
```

Enter the no of element to be sorted:6

Enter 6 elements:54

12

90

35

81

16

The sorted array is:

12 16 35 54 81 90

17. Aim: Arrange the list of numbers in ascending order using Selection Sort.

```
#include<stdio.h>
#include<conio.h>
void Selectionsort(int[],int);
void main()
{
int x[20],i,n;
clrscr();
printf("\n Enter the no of element to be sorted:");
scanf("%d",&n);
printf("\n Enter %d elements:",n);
for(i=0;i<n;i++)
scanf("%d",&x[i]);
Selectionsort(x,n);
printf("\n The sorted array is:\n");
for(i=0;i<n;i++)
printf("%4d",x[i]);
getch();
}
void Selectionsort(int a[],int n)
{
int i,j,pos,large;
for(i=n-1;i>0;i--)
{
large=a[0];
pos=0;
for(j=1;j<=i;j++)
{
if (a[j]>large)
{
large=a[j];
pos=j;
}
}
a[pos]=a[i];
a[i]=large;
}
}
```

Output:

```
Enter the no of element to be sorted:7

Enter 7 elements:45
12
32
10
34
67
41

The sorted array is:
10 12 32 34 41 67 45
```

18. Aim: Arrange the list of numbers in ascending order using Merge Sort.

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

void Mergesort(int[],int,int);
void Merge(int[],int,int,int);
void main()
{
int x[20],i,n;
clrscr();
printf("\n Enter the no of element to be sorted:");
scanf("%d",&n);
printf("\n Enter %d elements:",n);
for(i=0;i<n;i++)
scanf("%d",&x[i]);
Mergesort(x,0,n-1);
printf("\n The sorted array is:\n");
for(i=0;i<n;i++)
printf("%4d",x[i]);
getch();
}
```

```

void Mergesort(int a[],int p,int r)
{
int q;
if(p<r)
{
q=(p+r)/2;
Mergesort(a,p,q);
Mergesort(a,q+1,r);
Merge(a,p,q,r);
}
}
void Merge(int a[], int p, int q,int r)
{
int b[20],l1,r1,i;
l1=p;
r1=q+1;
i=p;
while((l1<=q)&&(r1<=r))
{
if(a[l1]<a[r1])
{
b[i]=a[l1];
l1=l1+1;
i=i+1;
}
else
{
b[i]=a[r1];
r1=r1+1;
i=i+1;
}
}
while(l1<=q)
{
b[i]=a[l1];
l1=l1+1;
i=i+1;
}
while(r1<=r)
{
b[i]=a[r1];
r1=r1+1;
i=i+1;
}
for(i=p;i<=r;i++)
a[i]=b[i];
}

```

Output:

```
Enter the no of element to be sorted:8

Enter 8 elements:12
10
34
26
78
51
36
79

The sorted array is:
10 12 26 34 36 51 78 79_
```

19. Aim: Arrange the list of numbers in ascending order using Quick Sort.

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

void Quicksort(int[],int,int);
int partition(int[],int,int);
void main()
{
int x[20],i,n;
clrscr();
printf("\n Enter the no of element to be sorted:");
scanf("%d",&n);
printf("\n Enter %d elements:",n);
for(i=0;i<n;i++)
scanf("%d",&x[i]);
Quicksort(x,0,n-1);
```



```

printf("\n The sorted array is:\n");
for(i=0;i<n;i++)
printf("%4d",x[i]);
getch();
}
void Quicksort(int a[],int p,int r)
{
int q;
if(p<r)
{
q=Partition(a,p,r);
Quicksort(a,p,q);
Quicksort(a,q+1,r);
}
}
int Partition(int a[], int p,int r)
{
int k,i,j,temp;
k=a[p];
i=p-1;
j=r+1;
while(1)
{
do
{
j=j-1;
}while(a[j]>k);
do
{
i=i+1;
}while(a[i]<k);
if(i<j)
{
temp=a[i];
a[i]=a[j];
a[j]=temp;
}
else
return(j);
}
}

```

Output:

```

Enter the no of element to be sorted:9

Enter 9 elements:23
12
41
30
40
90
60
49
89

The sorted array is:
12 23 30 40 41 49 60 89 90

```

20. Aim: Arrange the list of numbers in ascending order using Radix Sort.

```

#include<stdio.h>
#include<conio.h>

void Radixsort(int[],int);
void main()
{
int x[20],i,n;
clrscr();
printf("\n Enter the no of element to be sorted:");
scanf("%d",&n);
printf("\n Enter %d elements:",n);
for(i=0;i<n;i++)
scanf("%d",&x[i]);
Radixsort(x,n);
printf("\n The sorted array is:\n");
for(i=0;i<n;i++)
printf("%4d",x[i]);
getch();
}
void Radixsort(int a[],int n)

```

```

{
int bucket[10][10],buck[10];
int i,j,k,l,num,div,large,pass;
div=1;
num=0;
large=a[0];
for(i=0;i<n;i++)
{
if(a[i]>large)
large=a[i];
}
while(large>0)
{
num=num+1;
large=large/10;
}
for(pass=0;pass<num;pass++)
{
for(k=0;k<10;k++)
buck[k]=0;
for(i=0;i<n;i++)
{
l=(a[i]/div)%10;
bucket[l][buck[l]++]=a[i];
}
i=0;
for(k=0;k<10;k++)
{
for(j=0;j<buck[k];j++)
a[i++]=bucket[k][j];
}
div=div*10;
}
}

```

Output:

```
Enter the no of element to be sorted:6
```

```
Enter 6 elements:102
```

```
401
```

```
34
```

```
95
```

```
305
```

```
289
```

```
The sorted array is:
```

```
34 95 102 289 305 401
```

21. Aim: Arrange the list of numbers in ascending order using Heap Sort.

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

```
#include<conio.h>
```

```
void Heapsort(int[],int);
```

```
int Parent(int);
```

```
int Left(int);
```

```
int Right(int);
```

```
void Heapify(int[],int,int);
```

```
void Buildheap(int[],int);
```

```
void main()
```

```
{
```

```
int x[20],i,n;
```

```
clrscr();
```

```
printf("\n Enter the no of element to be sorted:");
```

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

```
printf("\n Enter %d elements:",n);
```

```

for(i=0;i<n;i++)
scanf("%d",&x[i]);
Heapsort(x,n);
printf("\n The sorted array is:\n");
for(i=0;i<n;i++)
printf("%4d",x[i]);
getch();
}
int Parent(int i)
{
return(i/2);
}
int Left(int i)
{
return(2*i+1);
}
int Right(int i)
{
return(2*i+2);
}
void Heapify(int a[],int i,int n)
{
int l,r,large,temp ;
l=Left(i);
r=Right(i);
if((l<=n-1)&&(a[l]>a[i]))
large=l;
else
large=i;
if((r<=n-1)&&(a[r]>a[large]))
large=r;
if(large!=i)
{
temp=a[i];
a[i]=a[large];
a[large]=temp;
Heapify(a,large,n);
}
}
void Buildheap(int a[],int n)
{
int i;
for(i=(n-1)/2;i>=0;i--)Heapify(a,i,n);
}
void Heapsort(int a[],int n)
{

```

```
int i,m,temp;
Buildheap(a,n);m=n;
for(i=n-1;i>=1;i--)
{
temp=a[0];
a[0]=a[i];
a[i]=temp;
m=m-1;
Heapify(a,0,m);
}
}
```

Output:

```
Enter the no of element to be sorted:9
Enter 9 elements:23
67
45
89
70
90
34
12
36

The sorted array is:
12 23 34 36 45 67 70 89 90_
```