Q1.

```cpp
#include<iostream>
using namespace std;
int c1=0;
void merge(int a[],int l,int r)
{       int mid;
        if(l>=r)
        return;
        mid=(l+r)/2;
        merge(a,l,mid);
        merge(a,mid+1,r);
        int b[100],i=l,j=mid+1,k=l;
        while(i<=mid && j<=r)
        {c1++;
                if(a[i]<a[j])
                {
                        b[k]=a[i];
                        i++;
                }
                else
                {
                        b[k]=a[j];
                        j++;
                }
                k++;
        }
```

```c
            if(i>mid && j<=r)

            {

                    while(j<=r)

                    {

                            b[k]=a[j];

                            j++;

                            k++;

                    }

            }

            else if(i<=mid && j>r)

            {

                    while(i<=mid)

                    {

                            b[k]=a[i];

                            k++;

                            i++;

                    }

            }

            for(k=l;k<=r;k++)

            a[k]=b[k];


}

main()

{

        int a[100];
```

```cpp
int n,t,p,i,j,c,key;

cout<<"enter t";

cin>>t;

for(p=0;p<t;p++)

{

cout<<"enter n";

cin>>n;

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

cin>>a[i];

int inv=0;

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

for(j=i+1;j<n;j++)

if(a[i]>a[j])

inv++;


merge(a,0,n-1);

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

cout<<a[i]<<" "<<endl;

cout<<"COMAPRISONS"<<c1<<endl;

cout<<"INVERSIONS"<<inv<<endl;

c1=0;

}
return 0;


}
```

OUTPUT-

enter t3

enter n8

23 65 21 76 46 89 45 32

21 23 32 45 46 65 76 89

COMAPRISONS16

INVERSIONS13

enter n10

54 65 34 76 78 97 46 32 51 21

21 32 34 46 51 54 65 76 78 97

COMAPRISONS22

INVERSIONS28

enter n15

63 42 223 645 652 31 324 22 553 12 54 65 86 46 325

12 22 31 42 46 54 63 65 86 223 324 325 553 645 652

COMAPRISONS43

INVERSIONS54

Q2.

```cpp
#include<iostream>
#include<cstdlib>
using namespace std;
int c1=0;
int s=0;
void quick_sort(int a[],int lb,int ub)
{
if(lb>=ub)
{return ;}
while(i<j)
{c1++;
s++;
while(a[i]<=key &&i<j)
{i++;
}
while(a[j]>key)
{
j--;
}
if(i<j)
{
c1++;
s++;
temp=a[i];
```

```cpp
a[i]=a[j];

a[j]=temp;

}}

a[lb]=a[j];

a[j]=key;

c1++;

quick_sort(a,lb,j-1);

quick_sort(a,j+1,ub);}

main(){

int a[100];

int n,t,p,i,j,c,key;

cout<<"enter t";

cin>>t;

for(p=0;p<t;p++)

{

cout<<"enter n";

cin>>n;

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

cin>>a[i];

quick_sort(a,0,n-1);

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

cout<<a[i]<<" "<<endl;

cout<<c1<<" "<<s;

c1=0,s=0;}

return 0;

}
```

enter t3

enter n8

23 65 21 76 46 89 45 32

21 23 32 45 46 65 76 89

Comparisons14 swaps10

enter n10

54 65 34 76 78 97 46 32 51 21

21 32 34 46 51 54 65 76 78 97

Comparisons22 swaps16

enter n15

63 42 223 645 652 31 324 22 553 12 54 65 86 46 325

12 22 31 42 46 54 63 65 86 223 324 325 553 645 652

Comparisons38 swaps29

Q3.

```cpp
#include<iostream>
using namespace std;
void quick_sort(int a[],int lb,int ub)
{

    int temp,key=a[lb],i=lb,j=ub;
    if(lb>=ub)
    return ;

    while(i<j)
    {
    while(a[i]<=key &&i<j)
    i++;

    while(a[j]>key)
    j--;
    if(i<j)
    {

    temp=a[i];
    a[i]=a[j];
    a[j]=temp;
    }
    }
    a[lb]=a[j];
```

```cpp
a[j]=key;

quick_sort(a,lb,j-1);

quick_sort(a,j+1,ub);

}

main()

{

int a[100];

int n,t,p,i,j,c,key;

cout<<"enter t";

cin>>t;

for(p=0;p<t;p++)

{

cout<<"enter n";

cin>>n;

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

cin>>a[i];

cout<<"enter the key";

cin>>key;

quick_sort(a,0,n-1);

if(key>n)

cout<<"NOT present";

else

{

cout<<"for k smallest:"<<endl<<a[key-1]<<endl<<"for k largest:"<<endl<<a[n-key]<<endl;

}}}
```

enter t2

enter n10

123 656 54 765 344 514 765 34 765 234

enter the key3

for k smallest:

123

for k largest:

765

enter n15

43 64 13 78 864 346 786 456 21 19 8 434 76 270 601

enter the key8

for k smallest:

78

for k largest:

78