

QUICKSORT :

```
#include<bits/stdc++.h>
using namespace std;
const int N=1e5+1;
int arr[N];
int Noc=0;
int partition(int arr[], int low, int high)
{
    int pivot = arr[low];
    int i = low - 1, j = high + 1;

    while (true) {
        do {
            i++;
            Noc++;
        } while (arr[i] < pivot);
        do {
            j--;
            Noc++;
        } while (arr[j] > pivot);
        if (i >= j)
            return j;

        swap(arr[i], arr[j]);
    }
}

int randomPivot(int arr[], int low, int high)
{
    int random = low + rand() % (high - low);

    swap(arr[random], arr[low]);

    return partition(arr, low, high);
}

void quickSort(int arr[], int low, int high)
{
    if (low < high) {
        int pi = randomPivot(arr, low, high);
        quickSort(arr, low, pi);
        quickSort(arr, pi + 1, high);
    }
}

int main()
{
    int t=100;
```

```

srand(time(0));
ofstream outdata;
ofstream outdata2;
outdata.open("Quicksort.txt");
outdata2.open("QuicksortComp.txt");
outdata2<<"ITERATION NO. |"<<"\t| I/P size\t"<<"\t| Comparisons\t"<<"\t| Time
(sec)"<<endl<<endl;
while(t--)
{
    clock_t start, end;
    cout<<endl;
    outdata<<endl;
    outdata<<"\n-----\n\n";
    cout<<"\tITERATION NO.-->"<<100-t<<"\n";
    outdata<<"\tITERATION NO.-->"<<100-t<<"\n";

    start = clock();
    int lb = 20, ub = 1000;
    int l=30,u=1000;
    int n=(rand() % (u - l + 1)) + l ;
    cout<<endl;
    cout<<"\tSize of array-->"<<n<<"\n\n";
    outdata<<endl;
    outdata<<"\tSize of array-->"<<n<<"\n\n";

    for(int i=0;i<n;i++)
    {
        int x=(rand() % (ub - lb + 1)) + lb;
        cout<<x<<" ";
        outdata<<x<<" ";
        arr[i]=x;
    }
    cout<<endl;
    outdata<<endl;

    quickSort(arr, 0, n - 1);
    cout<<"\n\tSorted array\n\n";
    outdata<<"\n\nSORTED ARRAY\n\n";

    for (int i = 0; i < n; i++)
    {
        cout<<arr[i]<<" ";
        outdata<<arr[i]<<" ";
    }
    cout<<"\n\nTOTAL NUMBER OF COMPARISONS--> "<<Noc<<"\n\n";
    outdata<<"\n\nTOTAL NUMBER OF COMPARISONS--> "<<Noc<<"\n\n"; end =
    clock();

```

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double time_taken = double(end - start) / double(CLOCKS_PER_SEC);
```

```
cout << "Time taken by ITERATION "<<100<<" is : " << fixed
<< time_taken << setprecision(5);
cout << " sec " << endl<<endl;
```

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outdata << "Time taken by ITERATION "<<100<<" is : " << fixed
<< time_taken << setprecision(5);
outdata << " sec " << endl<<endl;
```

```
outdata2<<"\t"<<100<<"\t"<<n<<"\t"<<Noc<<"\t"<< fixed<<time_taken <<
setprecision(5)<<"\n";
Noc=0;
cout<<"\n-----\n\n";
outdata<<"\n-----\n\n";
}
}
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OUTPUT :

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