Practical 1A

(Tanu Soni,88067)

Implement Insertion Sort (The program should report the number of comparisons) test runs the algorithm on 100 different inputs of sizes varying from 30 to 1000.Count the number of comparisons and draw the graph. Compare it with a graph of nlogn.

Code

```
#include <cstdlib>
#include <iomanip>
#include <iostream>
using namespace std;

void insertionSort(int arr[], int n){

int i, key, j; int count=0;
for (i = 1; i < n; i++){
    key = arr[i];
     j = i - 1;
    while (j >= 0 && arr[j] > key){
         count++;
          arr[j+ 1] =arr[ j];
          j -=1;
}
    arr[j+1] = key;
}

cout<<"\n"<<setw(9)<<n;


cout<<setw(25)<< count;

}



int main(){
 cout<<"+---------------------------------------+"<<endl;
 cout<<"| No. of elements |  No. of comparisons  |"<<endl;
```

```
 for(int x=0; x<100; ++x){
    int n = rand() % 971 + 30;
    int* arr = new int [n];
    cout<<" ";
    for(int i=0; i<n; ++i){
        arr[i]= rand();
 }
   insertionSort(arr, n);
   cout<<endl;
   cout<<"------------------|-----------------------";
}

cout<<endl;
return 0;
}
```

Output

```
+---------------------------------------+
| No. of elements |  No. of comparisons  |

      517                    68246
------------------|-----------------------
       58                     1035
------------------|-----------------------
      799                   163718
------------------|-----------------------
      547                    74890
------------------|-----------------------
       91                     2100
------------------|-----------------------
      761                   147015
------------------|-----------------------
      947                   220520
------------------|-----------------------
      883                   190566
------------------|-----------------------
      702                   119425
------------------|-----------------------
      373                    35952
------------------|-----------------------
      381                    38629
```

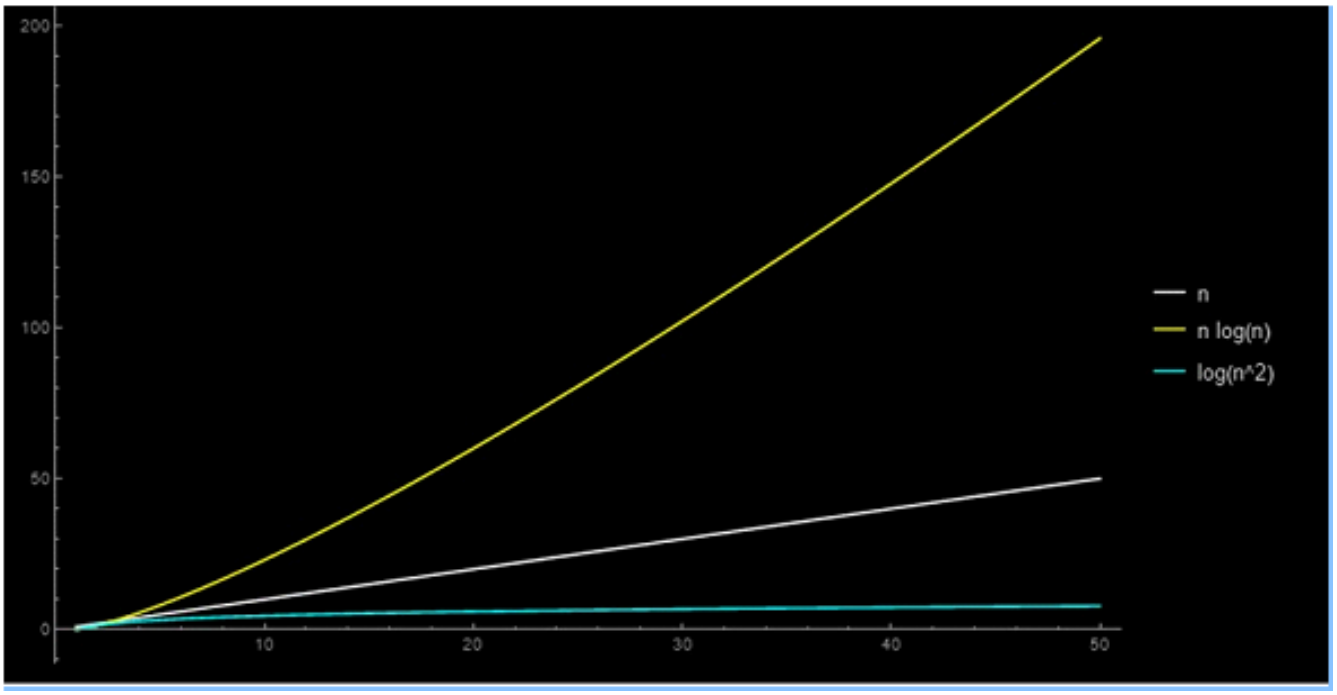
```
------------------|-----------------------
      395                   39755
------------------|-----------------------
      382                   35833
------------------|-----------------------
      679                  117593
------------------|-----------------------
       72                    1307
------------------|-----------------------
      104                    2581
------------------|-----------------------
      126                    3731
------------------|-----------------------
      830                  177983
------------------|-----------------------
      555                   74928
------------------|-----------------------
      996                  249395
------------------|-----------------------
      591                   83881
------------------|-----------------------
      613                   91088
------------------|-----------------------
      615                   95374
------------------|-----------------------
      772                  143789
------------------|-----------------------
      339                   29270
------------------|-----------------------
       45                     493
------------------|-----------------------
      584                   84361
------------------|-----------------------
      353                   30448
------------------|-----------------------
       73                    1274
------------------|-----------------------
      208                   10495
------------------|-----------------------
      546                   74701
------------------|-----------------------
       46                     489
------------------|-----------------------
      235                   13742
------------------|-----------------------
      311                   22804
------------------|-----------------------
```

```
      348                    30839
------------------|-----------------------
      236                    13785
------------------|-----------------------
      684                   117108
------------------|-----------------------
      890                   201703
------------------|-----------------------
      621                    92603
------------------|-----------------------
      107                     2526
------------------|-----------------------
      572                    82947
------------------|-----------------------
      301                    21765
------------------|-----------------------
       75                     1417
------------------|-----------------------
      428                    45779
------------------|-----------------------
      677                   121653
------------------|-----------------------
      423                    42745
------------------|-----------------------
      371                    32869
------------------|-----------------------
      713                   126136
------------------|-----------------------
      182                     8223
------------------|-----------------------
      283                    18443
------------------|-----------------------
      961                   224853
------------------|-----------------------
      160                     6037
------------------|-----------------------
      998                   251924
------------------|-----------------------
      653                   108688
------------------|-----------------------
      223                    11608
------------------|-----------------------
      305                    23413
------------------|-----------------------
      990                   248612
------------------|-----------------------
      373                    33534
```

```
------------------|-----------------------
      226                   12832
------------------|-----------------------
      694                  122758
------------------|-----------------------
      444                   47810
------------------|-----------------------
      634                  103567
------------------|-----------------------
      365                   34397
------------------|-----------------------
      274                   19146
------------------|-----------------------
      130                    3848
------------------|-----------------------
      153                    5743
------------------|-----------------------
      523                   71585
------------------|-----------------------
      614                   96299
------------------|-----------------------
      247                   14079
------------------|-----------------------
      422                   44281
------------------|-----------------------
       87                    1848
------------------|-----------------------
       79                    1610
------------------|-----------------------
      976                  233408
------------------|-----------------------
      825                  171845
------------------|-----------------------
      142                    4522
------------------|-----------------------
       81                    1396
------------------|-----------------------
      558                   77428
------------------|-----------------------
      952                  225933
------------------|-----------------------
      914                  201290
------------------|-----------------------
      377                   35689
------------------|-----------------------
      184                    8239
------------------|-----------------------
```

```
       50                    514
------------------|-----------------------
      997                  255641
------------------|-----------------------
      386                   36304
------------------|-----------------------
      616                   93669
------------------|-----------------------
      459                   54137
------------------|-----------------------
      979                  236937
------------------|-----------------------
      147                    5071
------------------|-----------------------
      569                   82597
------------------|-----------------------
      745                  136366
------------------|-----------------------
      164                    6607
------------------|-----------------------
      912                  206429
------------------|-----------------------
      740                  136149
------------------|-----------------------
      774                  142692
------------------|-----------------------
      919                  216703
------------------|-----------------------
      608                   93604
------------------|-----------------------
      206                   10668
------------------|-----------------------
      339                   28086
------------------|-----------------------
      769                  152376
------------------|-----------------------
      709                  123349
------------------|-----------------------
```

Graph of nlogn:



Graph of Insertion Sorting's comparison: