Code (Insertion Sort)

```python
# Insertion sort, with comparison (Best, Average, Worst case)
import random as random
import matplotlib.pyplot as plt


def insertion_sort(array):
    cmp = 0 # comparison variable
    for i in range(1,len(array)):
        key = array[i]
        j = i-1
        while j>= 0 and key < array[j]:
            array[j+1] = array[j]
            j -= 1
            cmp += 1
        array[j+1] = key
    cmp_list.append(cmp)
    print(cmp)

cmp_list = [] # initially empty
array = [] # initially empty
k=1
while k<11:
    for i in range(10):
      array.append(random.randint(1, 1000))
    print('Original' array end="\n")
```

```python
17          print(cmp)

18

19    cmp_list = [] # initially empty
20    array = [] # initially empty
21    k=1
22    while k<11:
23        for i in range(10):
24          array.append(random.randint(1, 1000))
25        print('Original',array,end="\n")
26        print('No. of comparisons:', end='')
27        insertion_sort(array)
28        print('Sorted',array)

29

30        print()
31        array.clear()
32        k += 1
33    print("Comparison List:", cmp_list)  # Comp List
34    print("Best Case Comparisons:", min(cmp_list)) #Best Case
35    print("Average Case Comparisons:", (sum(cmp_list))/10) #Average Case
36    print("Worst Case Comparisons:", max(cmp_list)) #Worst Case
37    plt.scatter(cmp_list,range(1,11))
38    plt.show()
```

Output

```
PS C:\Users\anika\OneDrive\Desktop\daa> python -u "c:\Users\anika\OneDrive\Desktop\daa\insertion.py"
Original [344, 960, 508, 55, 293, 821, 543, 196, 685, 984]
No. of comparisons:18
Sorted [55, 196, 293, 344, 508, 543, 685, 821, 960, 984]

Original [831, 354, 993, 657, 954, 544, 137, 158, 662, 158]
No. of comparisons:30
Sorted [137, 158, 158, 354, 544, 657, 662, 831, 954, 993]

Original [857, 798, 719, 312, 307, 238, 281, 840, 938, 225]
No. of comparisons:30
Sorted [225, 238, 281, 307, 312, 719, 798, 840, 857, 938]

Original [338, 752, 574, 641, 268, 782, 61, 372, 88, 867]
No. of comparisons:23
Sorted [61, 88, 268, 338, 372, 574, 641, 752, 782, 867]

Original [527, 612, 121, 670, 211, 613, 348, 590, 216, 349]
No. of comparisons:24
Sorted [121, 211, 216, 348, 349, 527, 590, 612, 613, 670]

Original [592, 879, 975, 15, 339, 1, 950, 206, 406, 485]
No. of comparisons:25
Sorted [1, 15, 206, 339, 406, 485, 592, 879, 950, 975]

Original [149, 185, 604, 700, 876, 968, 815, 321, 836, 859]
No. of comparisons:11
Sorted [149, 185, 321, 604, 700, 815, 836, 859, 876, 968]

Original [887, 679, 356, 517, 432, 58, 82, 154, 25, 187]
```

```
No. of comparisons:25
Sorted [1, 15, 206, 339, 406, 485, 592, 879, 950, 975]

Original [149, 185, 604, 700, 876, 968, 815, 321, 836, 859]
No. of comparisons:11
Sorted [149, 185, 321, 604, 700, 815, 836, 859, 876, 968]

Original [887, 679, 356, 517, 432, 58, 82, 154, 25, 187]
No. of comparisons:36
Sorted [25, 58, 82, 154, 187, 356, 432, 517, 679, 887]

Original [900, 814, 486, 298, 847, 191, 730, 70, 282, 779]
No. of comparisons:31
Sorted [70, 191, 282, 298, 486, 730, 779, 814, 847, 900]

Original [463, 56, 674, 229, 591, 427, 377, 439, 343, 696]
No. of comparisons:20
Sorted [56, 229, 343, 377, 427, 439, 463, 591, 674, 696]

Comparison List: [18, 30, 30, 23, 24, 25, 11, 36, 31, 20]
Best Case Comparisons: 11
Average Case Comparisons: 24.8
Worst Case Comparisons: 36
```

Comparison Graph