

~\OneDrive - VietNam National University - HCM INTERNATIONAL UNIVERSITY\Desktop\DSA\DSA LAB NEW\Lab 2
Simple sorting\ITITSB22029_DoMinhDuy_Lab2\Problem 3\InsertSortApp.java

```

1  class ArrayIns {
2      private long[] a; // ref to array a
3      private int nElems; // number of data items
4      private int innerLoopPasses; // number of passes of the inner loop
5      private int totalPasses; // total number of passes
6
7      // -----
8      public ArrayIns(int max) { // constructor
9          a = new long[max]; // create the array
10         nElems = 0; // no items yet
11         innerLoopPasses = 0; // initialize inner loop passes to 0
12         totalPasses = 0; // initialize total passes to 0
13     }
14
15     // -----
16     public void insert(long value) { // put element into array
17         a[nElems] = value; // insert it
18         nElems++; // increment size
19     }
20
21     // -----
22     public void display() { // displays array contents
23         for (int j = 0; j < nElems; j++) // for each element,
24             System.out.print(a[j] + " "); // display it
25         System.out.println("");
26     }
27
28     // -----
29     public void insertionSort() {
30         int in, out;
31
32         for (out = 1; out < nElems; out++) { // outer loop (out is dividing line)
33             long temp = a[out]; // remove marked item
34             in = out; // start shifts at out
35             innerLoopPasses = 0; // reset inner loop passes for this iteration
36
37             // Inner loop: shift items to the right until the right spot is found
38             while (in > 0 && a[in - 1] >= temp) { // until one is smaller,
39                 a[in] = a[in - 1]; // shift item to the right
40                 --in; // go left one position
41                 innerLoopPasses++; // increment inner loop passes
42             }
43
44             a[in] = temp; // insert marked item
45             totalPasses += innerLoopPasses; // accumulate total passes
46
47             // Display the array after each pass of the outer loop

```

```
48         System.out.println("After pass " + out + ":");
49         display();
50         System.out.println("Inner loop passes for this pass: " + innerLoopPasses);
51     }
52
53     System.out.println("Total inner loop passes: " + totalPasses);
54 }
55
56 public int getTotalPasses() {
57     return totalPasses;
58 }
59 }
60
61 ///////////////////////////////////////////////////
62
63 class InsertSortApp {
64     public static void main(String[] args) {
65         int maxSize = 100; // array size
66         ArrayIns arr; // reference to array
67         arr = new ArrayIns(maxSize); // create the array
68
69         arr.insert(77); // insert 10 items
70         arr.insert(99);
71         arr.insert(44);
72         arr.insert(55);
73         arr.insert(22);
74         arr.insert(88);
75         arr.insert(11);
76         arr.insert(00);
77         arr.insert(66);
78         arr.insert(33);
79
80         arr.display(); // display items
81
82         arr.insertionSort(); // insertion-sort them
83
84         arr.display(); // display them again
85
86         // Estimate the algorithm's complexity
87         int n = 10; // number of elements inserted
88         System.out.println("Estimated complexity (n*(n-1)/4): " + n * (n - 1) / 4);
89         System.out.println("The algorithm has O(n^2) complexity.");
90     }
91 }
92
```