Program Structures and Algorithms

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Task:

(Part 1) You are to implement three (3) methods (repeat, get Clock, and toMillisecs) of a class called Timer. Please see the skeleton class that I created in the repository. Timer is invoked from a class called Benchmark\_Timer which implements the Benchmark interface.

(Part 2) Implement InsertionSort (in the InsertionSort class) by simply looking up the insertion code used by Arrays.sort. If you have the instrument = true setting in test/resources/config.ini, then you will need to use the helper methods for comparing and swapping (so that they properly count the number of swaps/compares). The easiest is to use the helper.swapStableConditional method, continuing if it returns true, otherwise breaking the loop. Alternatively, if you are not using instrumenting, then you can write (or copy) your own compare/swap code. Either way, you must run the unit tests in InsertionSortTest.

(Part 3) Implement a main program (or you could do it via your own unit tests) to actually run the following benchmarks: measure the running times of this sort, using four different initial array ordering situations: random, ordered, partially-ordered and reverse-ordered. I suggest that your arrays to be sorted are of type Integer. Use the doubling method for choosing n and test for at least five values of n. Draw any conclusions from your observations regarding the order of growth.

Relationship Conclusion:

In terms of order of growth, the running time of Insertion sort arranged in ascending order

Evidence to support the conclusion:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Length of Array | Runs | Time per Run | Random  Array | Ordered  Array | partially ordered  Array | Reversed  ordered |
| 1000 | 100 | Raw time | 0.007 | 0.004 | 0.005 | 0.006 |
|  |  |  |  |  |  |  |
| 2000 | 50 | Raw time | 0.011 | 0.002 | 0.003 | 0.015 |
|  |  |  |  |  |  |  |
| 4000 | 20 | Raw time | 0.013 | 0.004 | 0.00425 | 0.023 |
|  |  |  |  |  |  |  |
| 8000 | 10 | Raw time | 0.025 | 0.0085 | 0.008625 | 0.034 |
|  |  |  |  |  |  |  |
| 16000 | 5 | Raw time | 0.40 | 0.0173125 | 0.0179375 | 0.56 |
|  |  |  |  |  |  |  |

Graphical Representation:

**Unit Test Screenshots:**

**Timer Test.java**

Graphical user interface, text

Description automatically generated

**InsertionSortTest.java**

Graphical user interface, text

Description automatically generated

Code Snippets:

Repeat function in Timer.javaText

Description automatically generated

Getclock() and tomillisecs() in Timer.java

Text

Description automatically generated

Text

Description automatically generatedDriver class for part 3

Text

Description automatically generated

