**Venkata Srinivas Kompally (NUID : 002137855)**

**Program Structures & Algorithms**

**Fall 2021**

**Assignment No. 2**

* **Task:**

**Part 1)** Implement three methods of class called Timer. 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.

**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.

* **Relationship Conclusion:**

The Order of Growth for Randomly Ordered Array of Size N is

The Order of Growth for Ordered Array of Size N is

The Order of Growth for Reverse Ordered Array of Size N is

The Order of Growth for Partially Ordered Array of Size N is

The Order of growth, based on running time of insertion sort is:

***Ordered < Partially Ordered < Randomly Ordered < Reverse Ordered***

* **Evidence to support the conclusion:**

1. **Output (Snapshot of Code output in the terminal)**

**A computer screen capture

Description automatically generated with medium confidence**

**A screenshot of a computer

Description automatically generated with medium confidence**

1. **Graphical Representation**

**Random Ordered Array:**

**Chart, line chart

Description automatically generated**

Initial input size is 200 and increased upto 3200. Calculated the running time of the soring algorithm Random Orderly.

Using Doubling Hypothesis:

For Function

N = Input Size

a = Constant

b = slope of the log-log graph

The average slope for Randomly Ordered Array is: 1.36

The Equation of such a line is:

l

**Chart, line chart

Description automatically generated**

The average slope for Ordered Array is: 0.80

The Equation of such a line is:

l

**Chart, line chart

Description automatically generated**

The average slope for Reverse Ordered Array is: 1.54

The Equation of such a line is:

l

**Chart, line chart

Description automatically generated**

The average slope for Partially Ordered Array is: 1.09

The Equation of such a line is:

l

* **Unit tests result:**

**Part 1 : Timer Test**

Text

Description automatically generated

Text

Description automatically generated

**Part 2: Insertion Sort**

Text

Description automatically generated