Program Structure and Algorithms

NAME: Apoorva Jain

NUID: 002764526

Task:

(Part 1) You are to implement three (3) methods (*repeat*, *getClock*, 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.

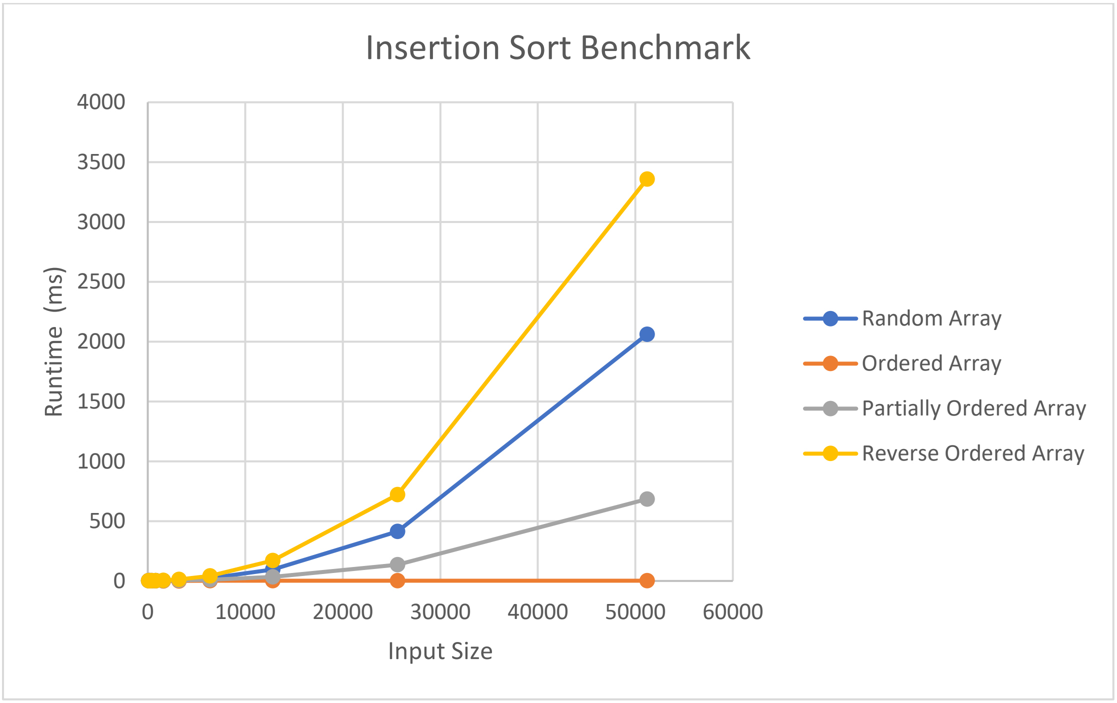
(Part 2) Implement *InsertionSort* (in the *InsertionSort* class) by simply looking up the insertion code used by *Arrays.sort.*

(Part 3) Implement a main program (or you could do it via your own unit tests) to run the benchmarks.

Explanation:

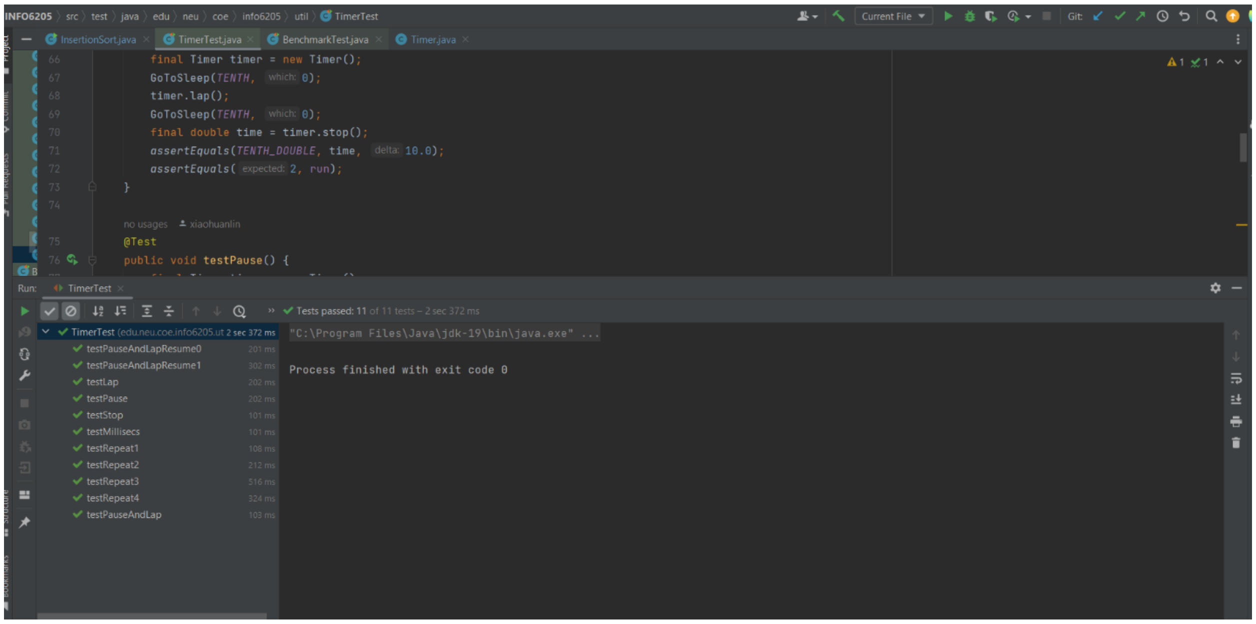
A random array's items are arranged randomly, leading to a sorting process that takes an average of O(n2) time. The method runs at its best when the array is already sorted, with a time complexity of O.(n).Some members in an array that has been partially sorted are in the right order, but others are not. Due to this, the algorithm's temporal complexity varies depending on the quantity of properly sorted items, falling between O(n) and O(n2). When an array's components are arranged in reverse, sorting requires repeated swaps of each element, which has a temporal complexity of O(n2) and requires the longest sorting time.

Graphical Representation:



Unit Test Cases:

TimerTest:



INFO6205 〉 src 〉 test 〉 java 〉 edu 〉 neu 〉 coe 〉 info6205 〉 util 〉 TimerTest

InsertionSort.java | TimerTest.java | BenchmarkTest.java | Timer.java

```java
        final Timer timer = new Timer();
        GoToSleep(TENTH, which: 0);
        timer.lap();
        GoToSleep(TENTH, which: 0);
        final double time = timer.stop();
        assertEquals(TENTH_DOUBLE, time, delta: 10.0);
        assertEquals( expected: 2, run);
    }

    no usages  xiaohuanlin
    @Test
    public void testPause() {
```

Run: TimerTest

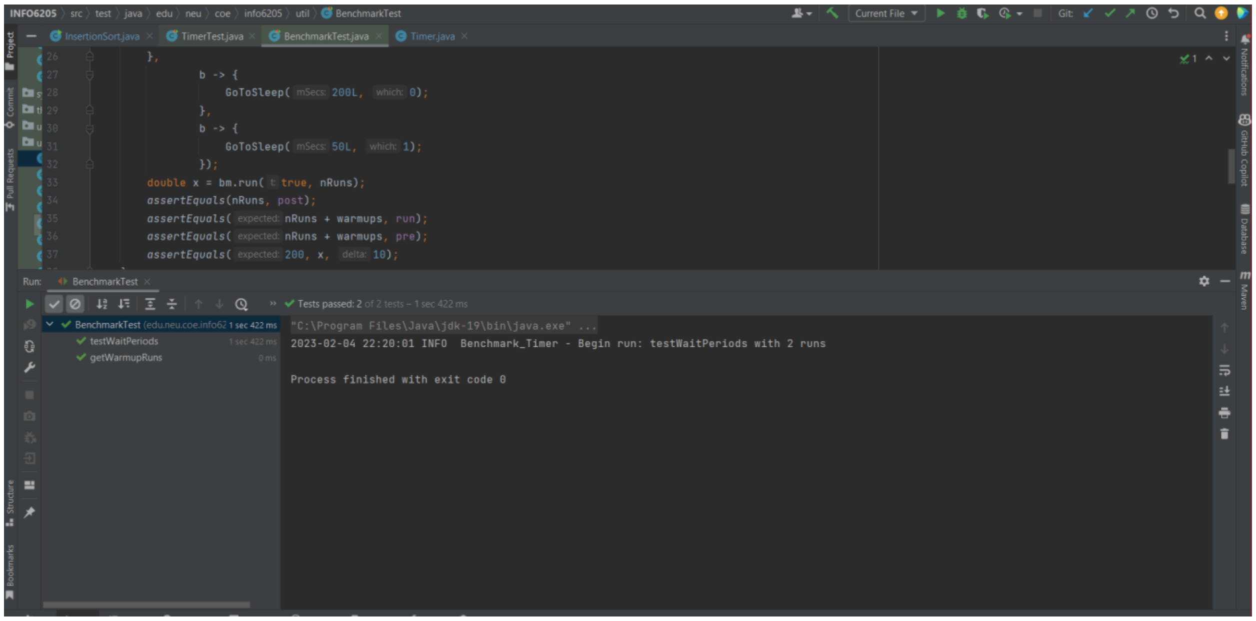
Tests passed: 11 of 11 tests – 2 sec 372 ms

```
TimerTest (edu.neu.coe.info6205.ut 2 sec 372 ms
    testPauseAndLapResume0     201 ms
    testPauseAndLapResume1     302 ms
    testLap                    202 ms
    testPause                  202 ms
    testStop                   101 ms
    testMillisecs              101 ms
    testRepeat1                108 ms
    testRepeat2                212 ms
    testRepeat3                516 ms
    testRepeat4                324 ms
    testPauseAndLap            103 ms
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" ...

Process finished with exit code 0
```

BenchmarkTest:



INFO6205 〉 src 〉 test 〉 java 〉 edu 〉 neu 〉 coe 〉 info6205 〉 util 〉 BenchmarkTest

InsertionSort.java | TimerTest.java | BenchmarkTest.java | Timer.java

```java
                },
                        b -> {
                            GoToSleep( mSecs: 200L, which: 0);
                        },
                        b -> {
                            GoToSleep( mSecs: 50L, which: 1);
                        });
                double x = bm.run( t: true, nRuns);
                assertEquals(nRuns, post);
                assertEquals( expected: nRuns + warmups, run);
                assertEquals( expected: nRuns + warmups, pre);
                assertEquals( expected: 200, x, delta: 10);
```

Run: BenchmarkTest

Tests passed: 2 of 2 tests – 1 sec 422 ms

```
BenchmarkTest (edu.neu.coe.info62 1 sec 422 ms
    testWaitPeriods     1 sec 422 ms
    getWarmupRuns               0 ms
```

```
"C:\Program Files\Java\jdk-19\bin\java.exe" ...
2023-02-04 22:20:01 INFO  Benchmark_Timer - Begin run: testWaitPeriods with 2 runs

Process finished with exit code 0
```