Program Structures and Algorithms
Fall 2022(SEC 06)

NAME: Olasunkanmi Olayinka
NUID: 001512266

Task:

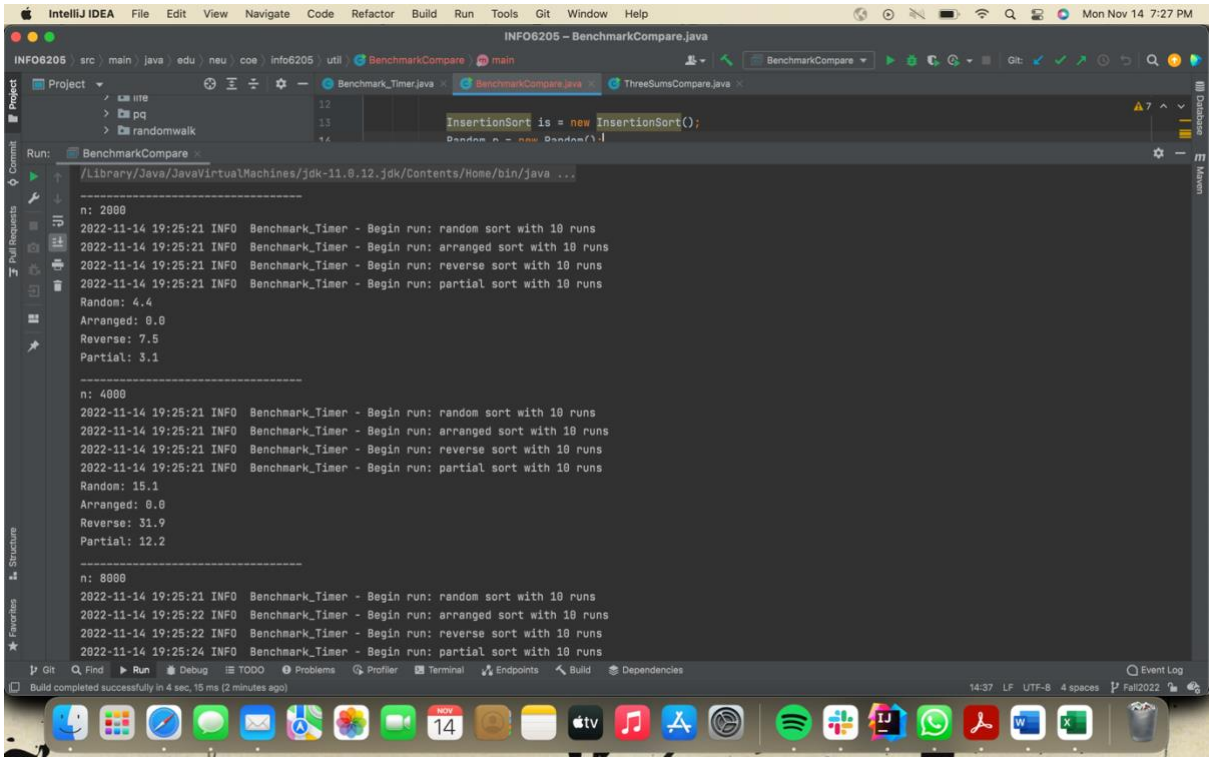
- Implement 3 methods (repeat, getClock and toMilliSecs) in Timer class
- Implement InsertionSort
- Implement a main program to run the benchmarks of the sorts for different array ordering (random, ordered, partially-ordered and reverse-ordered)
- Report observation

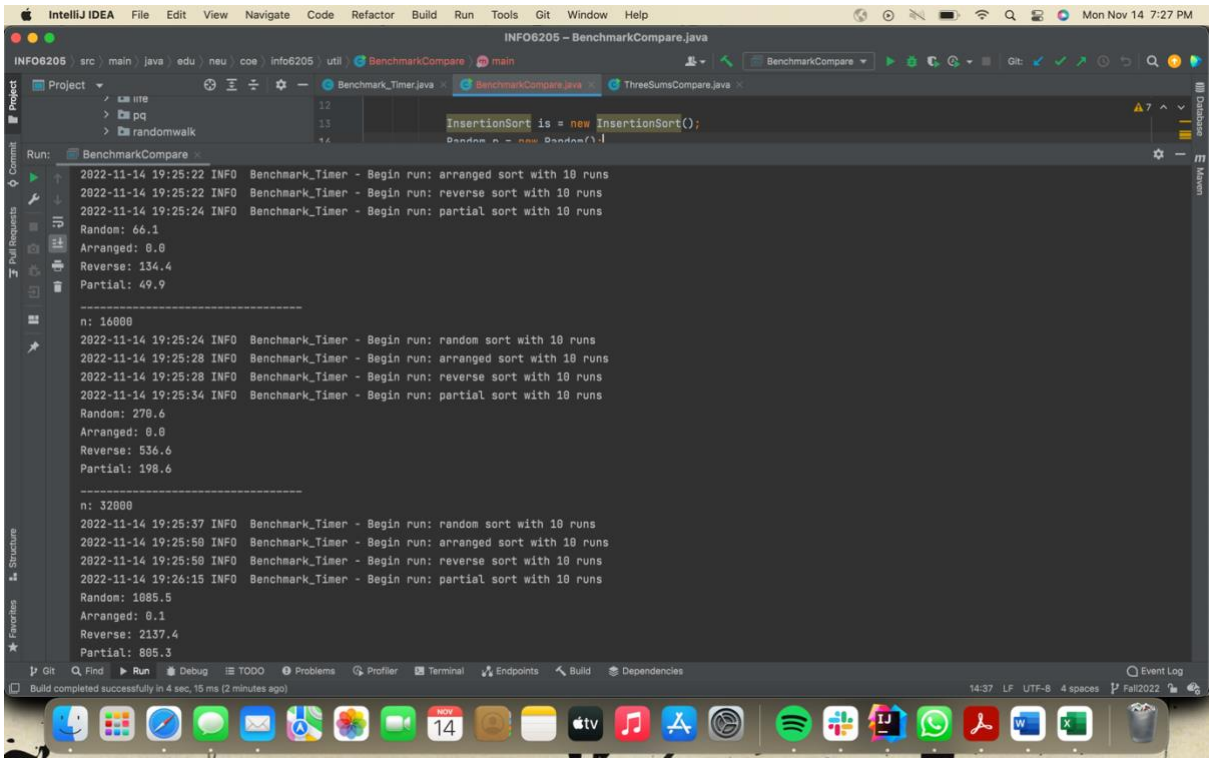
Relationship Conclusion:

Insertion sort is a quadratic function in time taken to sort (quadratic in nature) O(n^2). It can be concluded that an arranged array hardly takes anytime as no swaps is being done, followed by a partially-ordered array as the number of swaps is greatly reduced cause of some order, followed by random array. The reverse-ordered takes the most time because it swaps every pass, as nothing is in order.

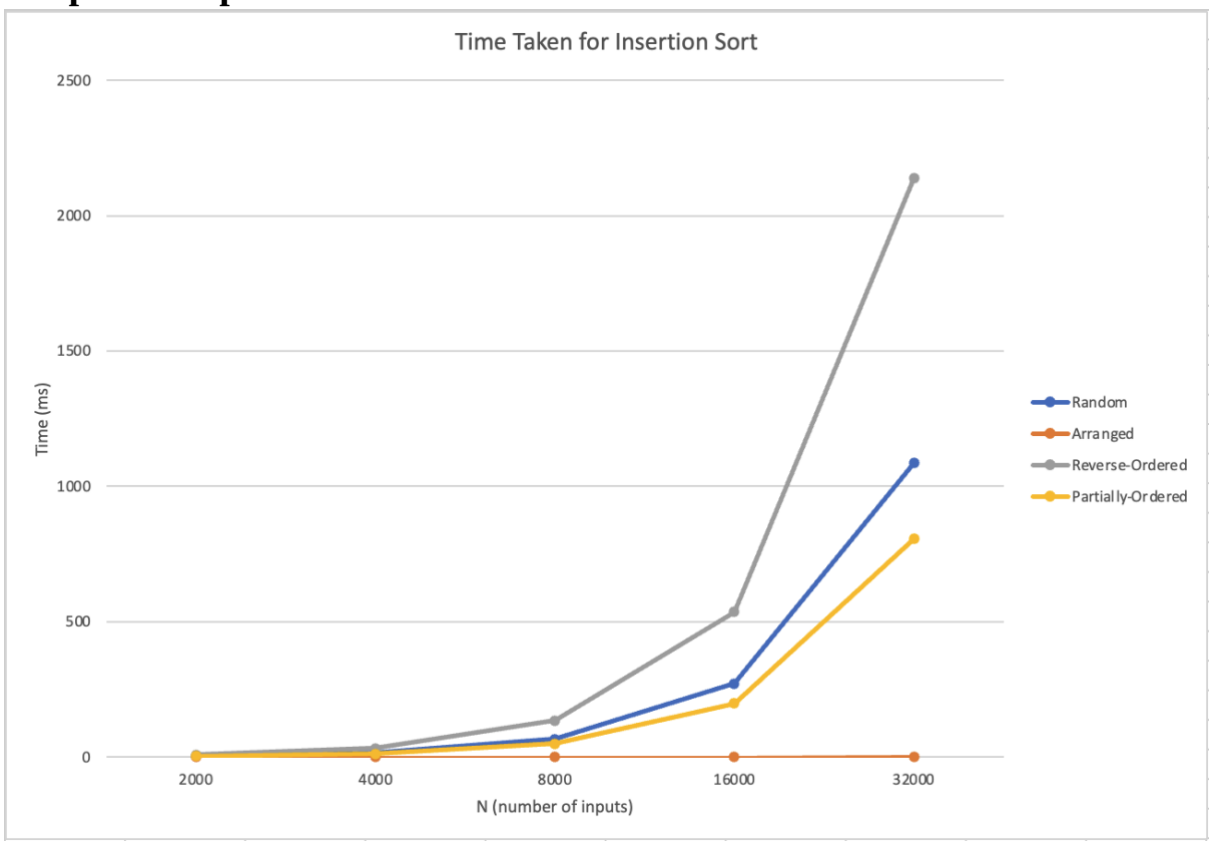
Evidence to support that conclusion:

N (number of inputs)	Random	Arranged	Reverse-Ordered	Partially-Ordered
2000	4	0	7.5	3.1
4000	15.1	0	31.9	12.2
8000	66.1	0	134.4	49.9
16000	270.6	0	536.6	198.6
32000	1085.5	0.1	2137.4	805.3


IntelliJ IDEA File Edit View Navigate Code Refactor Build Run Tools Git Window Help
Mon Nov 14 7:27 PM
INFO6205 – BenchmarkCompare.java
Run: BenchmarkCompare
/Library/Java/JavaVirtualMachines/jdk-11.0.12.jdk/Contents/Home/bin/java ...
n: 2000
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: random sort with 10 runs
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: arranged sort with 10 runs
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: reverse sort with 10 runs
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: partial sort with 10 runs
Random: 4.4
Arranged: 0.0
Reverse: 7.5
Partial: 3.1
n: 4000
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: random sort with 10 runs
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: arranged sort with 10 runs
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: reverse sort with 10 runs
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: partial sort with 10 runs
Random: 15.1
Arranged: 0.0
Reverse: 31.9
Partial: 12.2
n: 8000
2022-11-14 19:25:21 INFO Benchmark_Timer - Begin run: random sort with 10 runs
2022-11-14 19:25:22 INFO Benchmark_Timer - Begin run: arranged sort with 10 runs
2022-11-14 19:25:22 INFO Benchmark_Timer - Begin run: reverse sort with 10 runs
2022-11-14 19:25:24 INFO Benchmark_Timer - Begin run: partial sort with 10 runs
Build completed successfully in 4 sec, 15 ms (2 minutes ago)

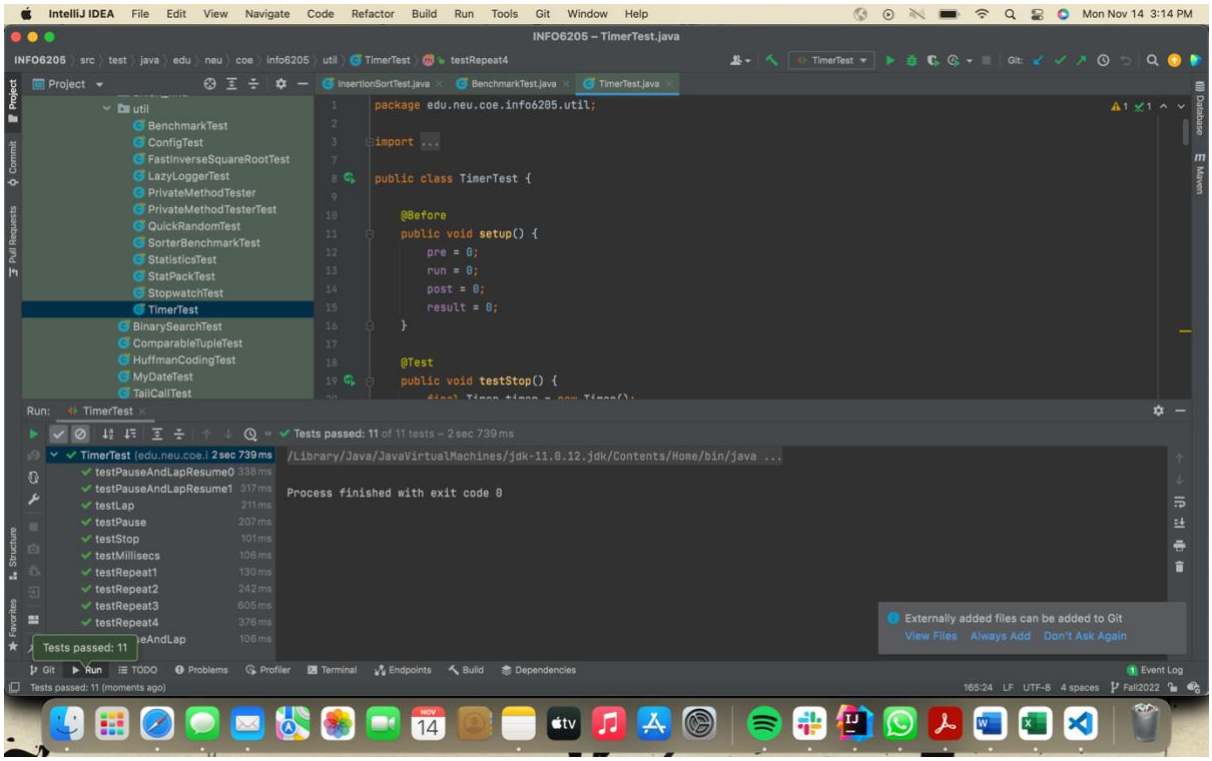

IntelliJ IDEA File Edit View Navigate Code Refactor Build Run Tools Git Window Help
Mon Nov 14 7:27 PM
INFO6205 – BenchmarkCompare.java
Run: BenchmarkCompare
2022-11-14 19:25:22 INFO Benchmark_Timer - Begin run: arranged sort with 10 runs
2022-11-14 19:25:22 INFO Benchmark_Timer - Begin run: reverse sort with 10 runs
2022-11-14 19:25:24 INFO Benchmark_Timer - Begin run: partial sort with 10 runs
Random: 66.1
Arranged: 0.0
Reverse: 134.4
Partial: 49.9
n: 16000
2022-11-14 19:25:24 INFO Benchmark_Timer - Begin run: random sort with 10 runs
2022-11-14 19:25:28 INFO Benchmark_Timer - Begin run: arranged sort with 10 runs
2022-11-14 19:25:28 INFO Benchmark_Timer - Begin run: reverse sort with 10 runs
2022-11-14 19:25:34 INFO Benchmark_Timer - Begin run: partial sort with 10 runs
Random: 270.6
Arranged: 0.0
Reverse: 536.6
Partial: 198.6
n: 32000
2022-11-14 19:25:37 INFO Benchmark_Timer - Begin run: random sort with 10 runs
2022-11-14 19:25:50 INFO Benchmark_Timer - Begin run: arranged sort with 10 runs
2022-11-14 19:25:50 INFO Benchmark_Timer - Begin run: reverse sort with 10 runs
2022-11-14 19:26:15 INFO Benchmark_Timer - Begin run: partial sort with 10 runs
Random: 1085.5
Arranged: 0.1
Reverse: 2137.4
Partial: 805.3
Build completed successfully in 4 sec, 15 ms (2 minutes ago)

Graphical Representation:

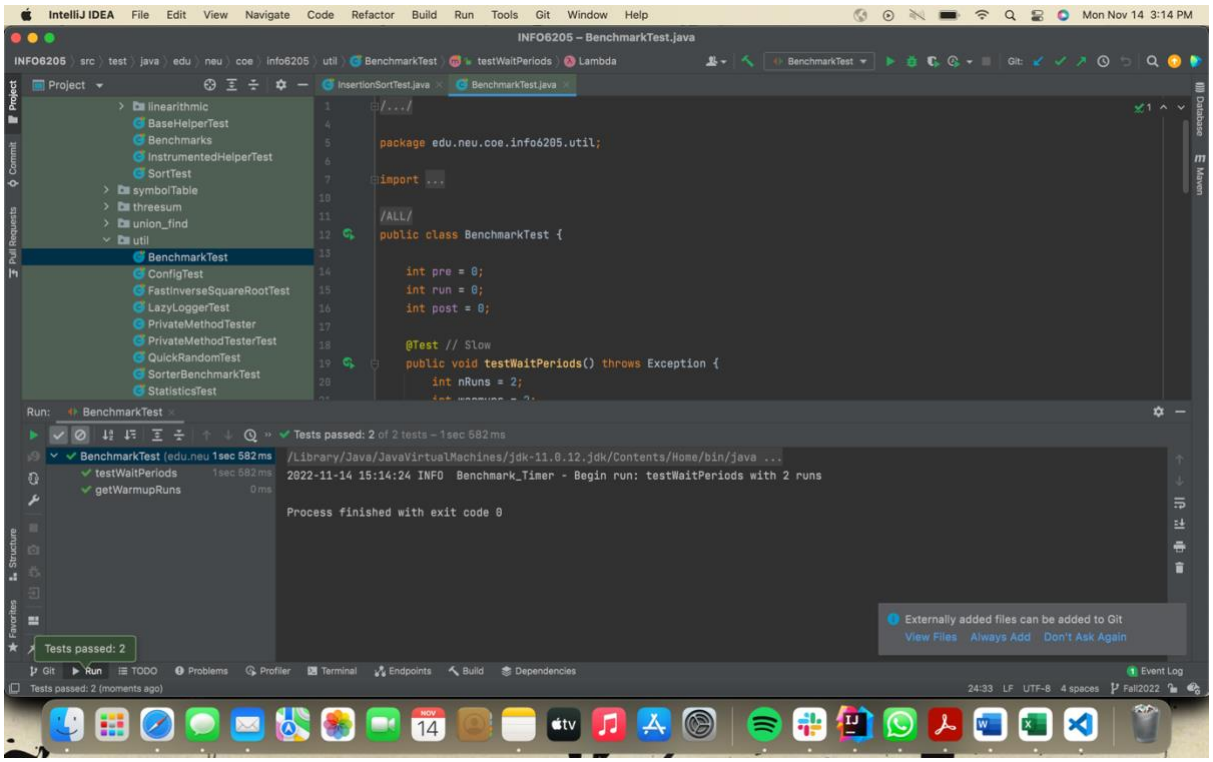


Unit Test Screenshots:

TimerTest



BenchmarkTest



InsertionSortTest