Program Structure and Algorithms (INFO-6205 SEC01)
Assignment – 2
Benchmark

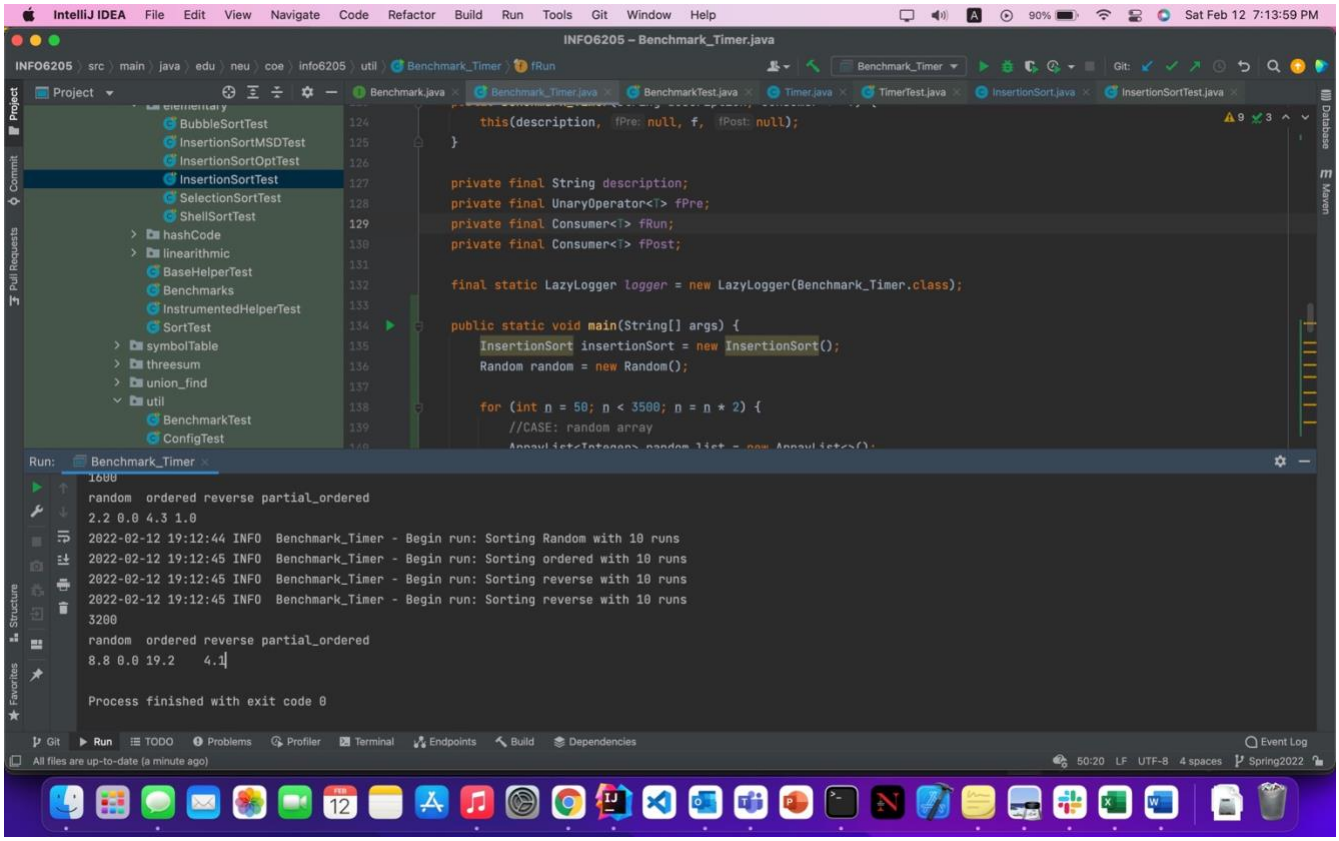
Name: Vivek Sharma
NUID: 002105272

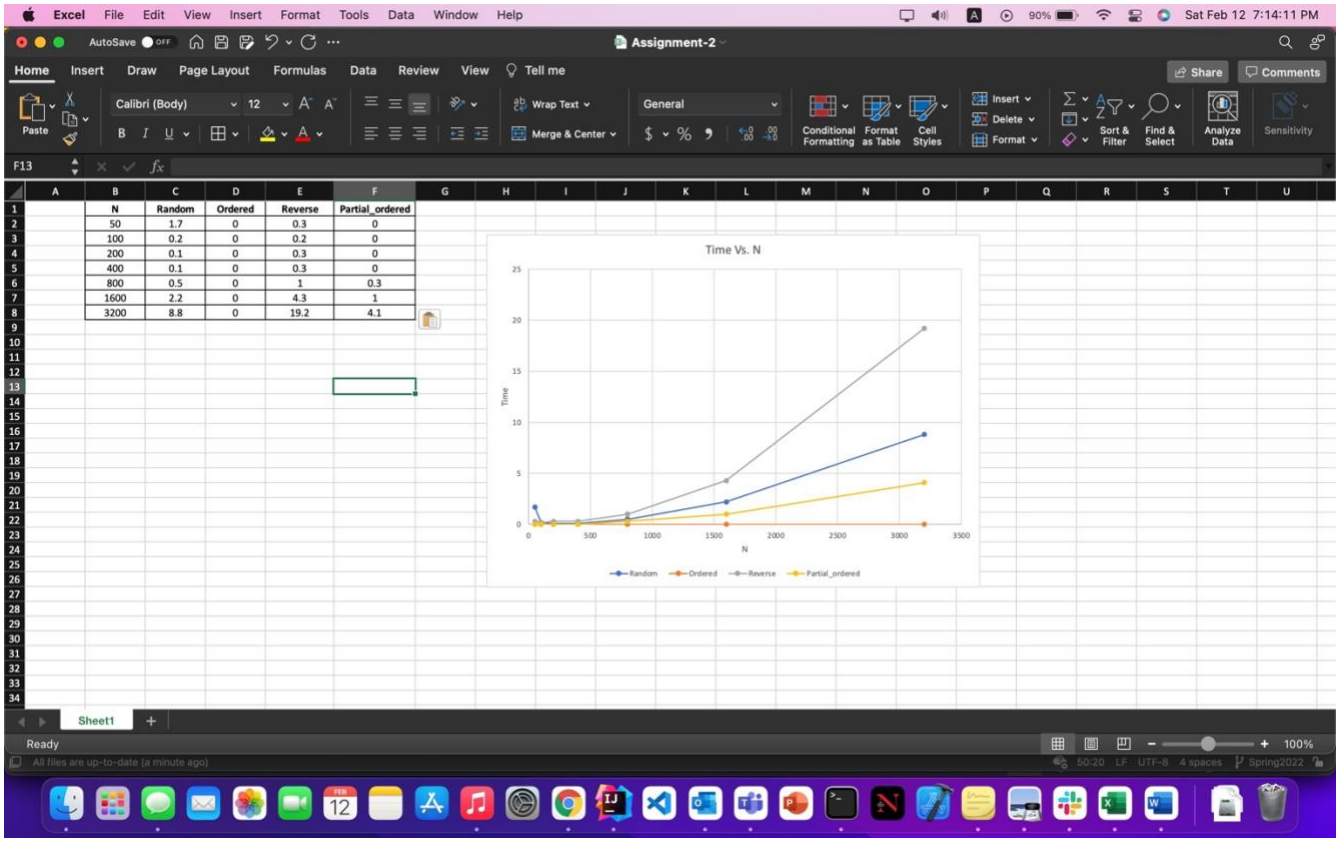
TASK

Task for this assignment is in three parts.

1. Implement three methods (*repeat*, *getClock*, and *toMillisecs*) of a class called *Timer*.
2. Implement Insertion Sort (in the InsertionSort class) by simply looking up the insertion code used by Arrays.sort.
3. Implement a main program 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.

OUTPUT SCREENSHOT





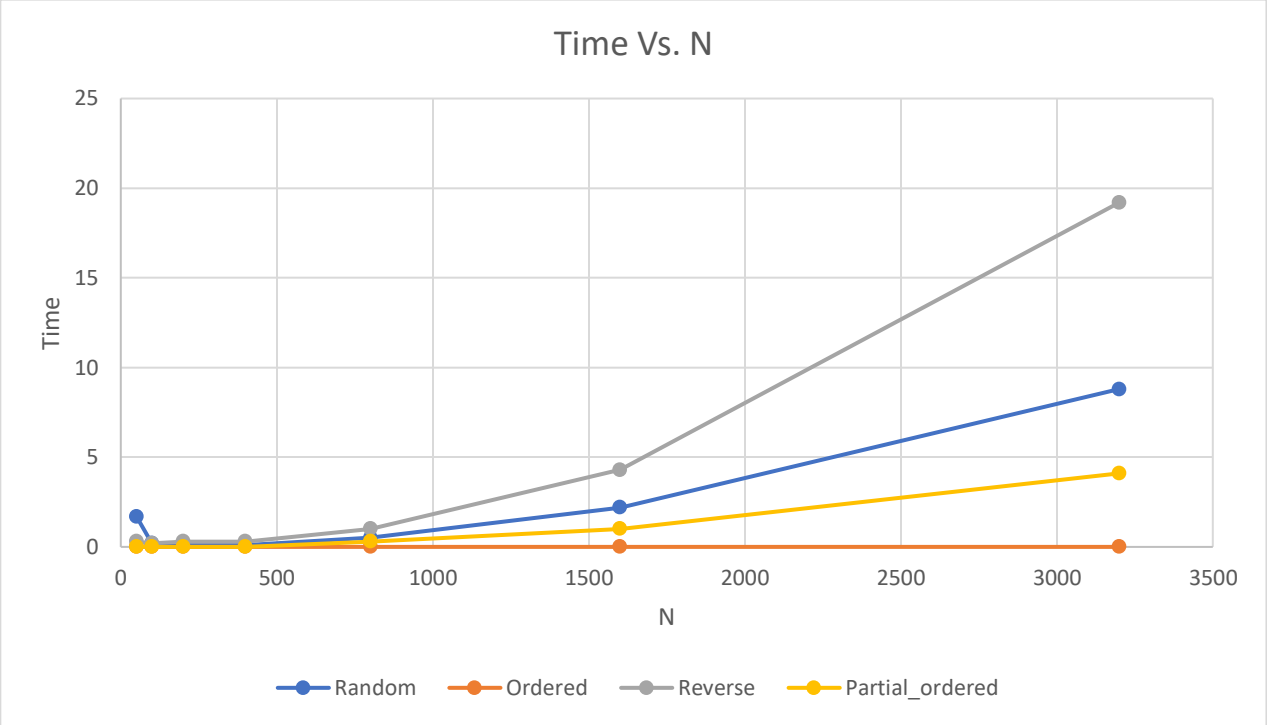
N	Random	Ordered	Reverse	Partial_ordered
50	1.7	0	0.3	0
100	0.2	0	0.2	0
200	0.1	0	0.3	0
400	0.1	0	0.3	0
800	0.5	0	1	0.3
1600	2.2	0	4.3	1
3200	8.8	0	19.2	4.1

CONCLUSION

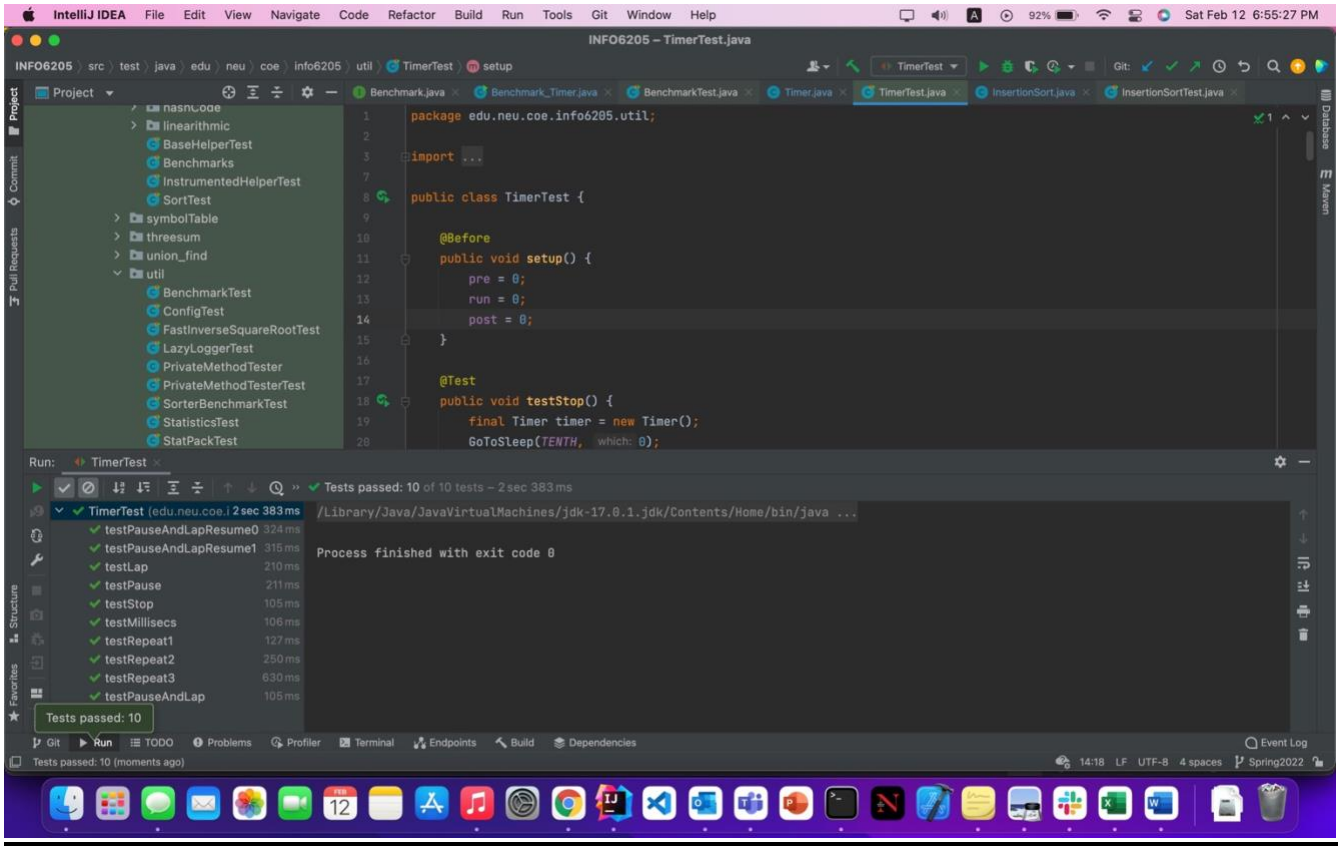
Reverse-ordered array has the highest sorting time according to the benchmark. It is followed by random-ordered arrays, then partial-ordered arrays and then ordered arrays. The worst-case scenario is for reverse ordered arrays sorting as it has $O(N^2)$ time complexity.

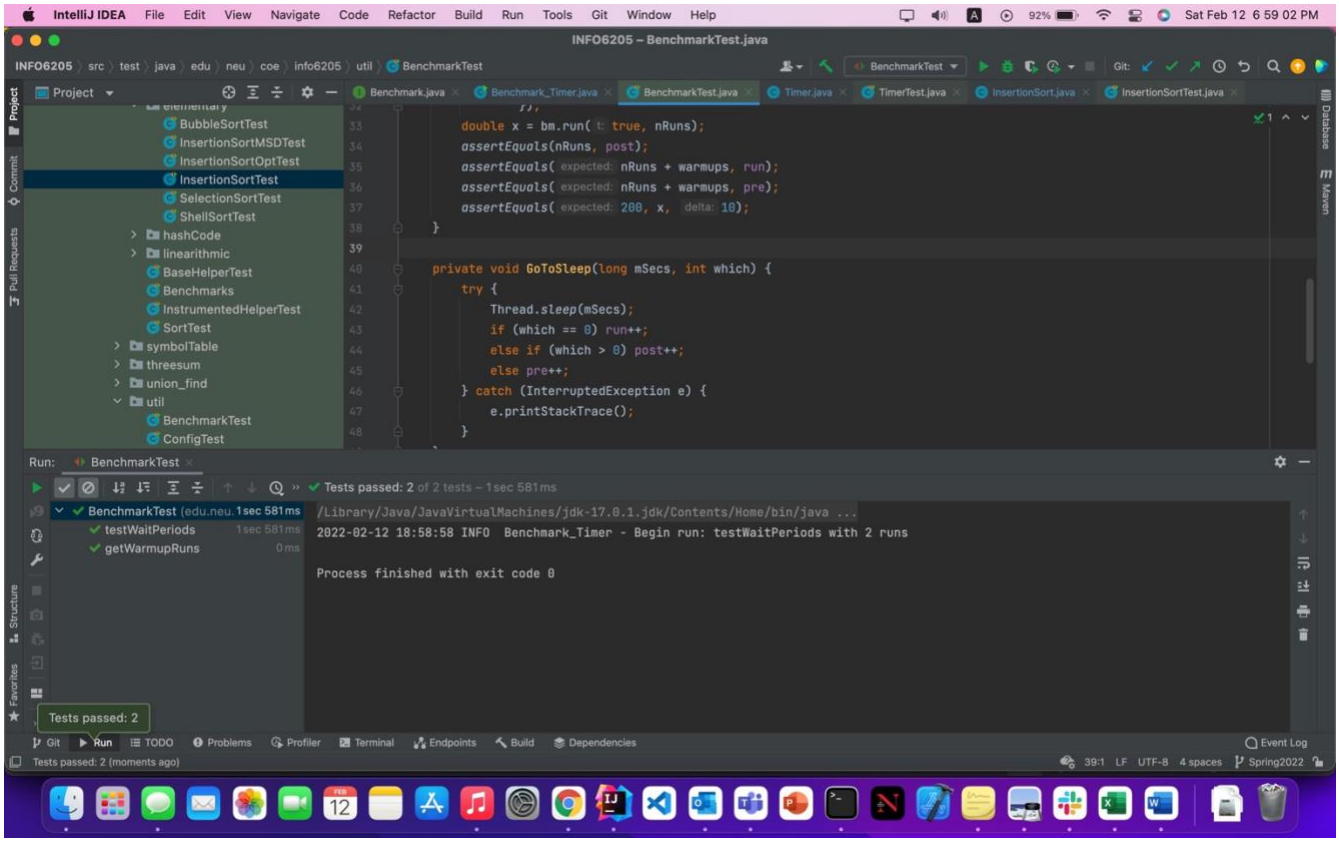
EVIDENCE

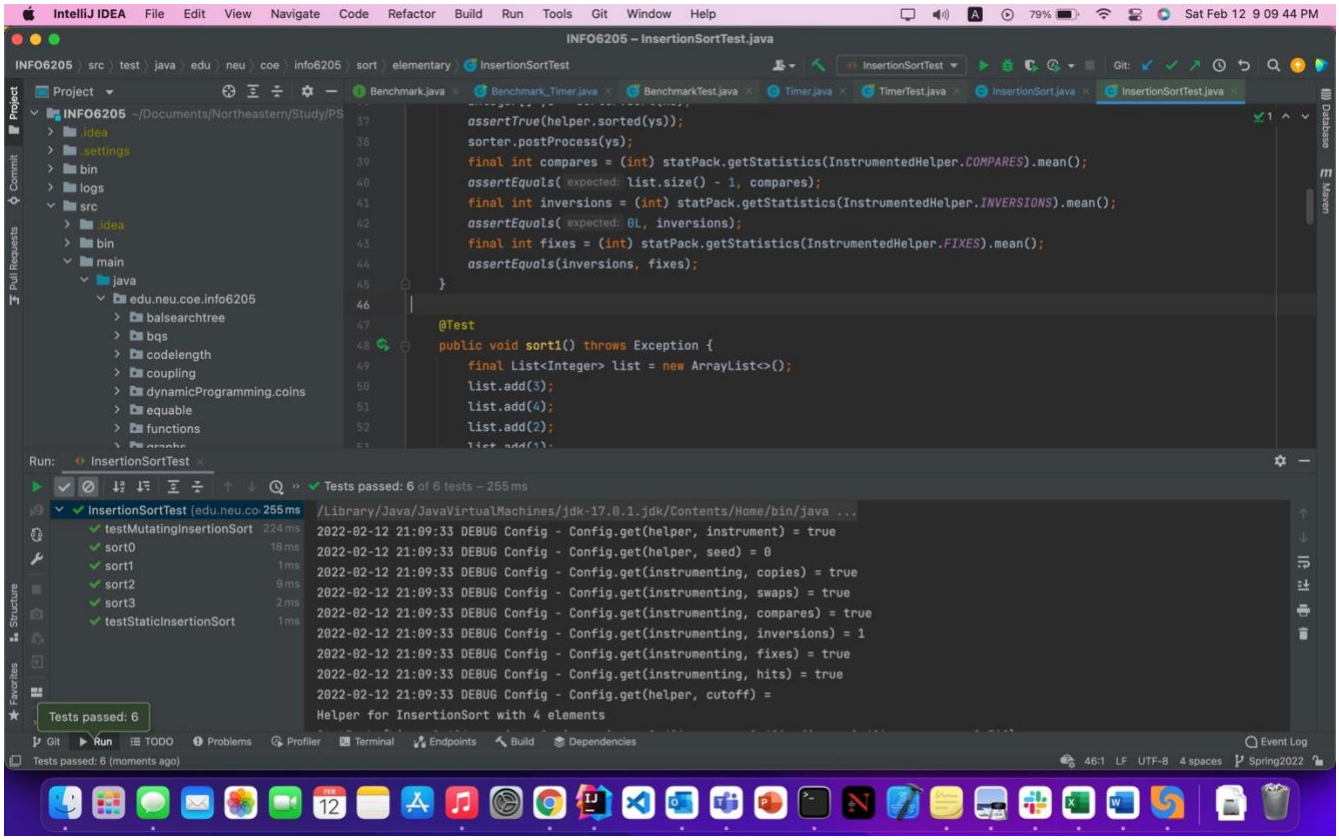
N	Random	Ordered	Reverse	Partial_ordered
50	1.7	0	0.3	0
100	0.2	0	0.2	0
200	0.1	0	0.3	0
400	0.1	0	0.3	0
800	0.5	0	1	0.3
1600	2.2	0	4.3	1
3200	8.8	0	19.2	4.1



UNIT TESTS:


IntelliJ IDEA File Edit View Navigate Code Refactor Build Run Tools Git Window Help
Sat Feb 12 6:55:27 PM
INFO6205 – TimerTest.java
Project
Benchmark.java
Benchmark_Timer.java
BenchmarkTest.java
Timer.java
TimerTest.java
InsertionSort.java
InsertionSortTest.java
linearithmic
BaseHelperTest
Benchmarks
InstrumentedHelperTest
SortTest
symbolTable
threesum
union_find
util
BenchmarkTest
ConfigTest
FastInverseSquareRootTest
LazyLoggerTest
PrivateMethodTester
PrivateMethodTesterTest
SorterBenchmarkTest
StatisticsTest
StatPackTest
package edu.neu.coe.info6205.util;
import ...
public class TimerTest {
@Before
public void setup() {
pre = 0;
run = 0;
post = 0;
}
@Test
public void testStop() {
final Timer timer = new Timer();
GoToSleep(TENTH, which: 0);
Run: TimerTest
Tests passed: 10 of 10 tests – 2 sec 383 ms
TimerTest (edu.neu.coe.i 2 sec 383 ms
testPauseAndLapResume0 324 ms
testPauseAndLapResume1 315 ms
testLap 210 ms
testPause 211 ms
testStop 105 ms
testMillisecs 106 ms
testRepeat1 127 ms
testRepeat2 250 ms
testRepeat3 630 ms
testPauseAndLap 105 ms
/Library/Java/JavaVirtualMachines/jdk-17.0.1.jdk/Contents/Home/bin/java ...
Process finished with exit code 0
Tests passed: 10
Git Run TODO Problems Profiler Terminal Endpoints Build Dependencies
Event Log
Tests passed: 10 (moments ago)
14:18 LF UTF-8 4 spaces Spring2022


IntelliJ IDEA File Edit View Navigate Code Refactor Build Run Tools Git Window Help
Sat Feb 12 6 59 02 PM
INFO6205 – BenchmarkTest.java
BubbleSortTest
InsertionSortMSDTest
InsertionSortOptTest
InsertionSortTest
SelectionSortTest
ShellSortTest
hashCode
linearithmic
BaseHelperTest
Benchmarks
InstrumentedHelperTest
SortTest
symbolTable
threesum
union_find
util
BenchmarkTest
ConfigTest
double x = bm.run(true, nRuns);
assertEquals(nRuns, post);
assertEquals(expected: nRuns + warmups, run);
assertEquals(expected: nRuns + warmups, pre);
assertEquals(expected: 200, x, delta: 10);
}
private void GoToSleep(long mSecs, int which) {
try {
Thread.sleep(mSecs);
if (which == 0) run++;
else if (which > 0) post++;
else pre++;
} catch (InterruptedException e) {
e.printStackTrace();
}
Run: BenchmarkTest
Tests passed: 2 of 2 tests – 1 sec 581 ms
BenchmarkTest (edu.neu. 1 sec 581 ms
testWaitPeriods 1 sec 581 ms
getWarmupRuns 0 ms
/Library/Java/JavaVirtualMachines/jdk-17.0.1.jdk/Contents/Home/bin/java ...
2022-02-12 18:58:58 INFO Benchmark_Timer - Begin run: testWaitPeriods with 2 runs
Process finished with exit code 0
Tests passed: 2
Git Run TODO Problems Profiler Terminal Endpoints Build Dependencies
Event Log
Tests passed: 2 (moments ago)
39:1 LF UTF-8 4 spaces Spring2022


IntelliJ IDEA File Edit View Navigate Code Refactor Build Run Tools Git Window Help
Sat Feb 12 9 09 44 PM
INFO6205 – InsertionSortTest.java
INFO6205 ~/Documents/Northeastern/Study/PS
.idea
.settings
bin
logs
src
.idea
bin
main
java
edu.neu.coe.info6205
balsearchtree
bqs
codelength
coupling
dynamicProgramming.coins
equable
functions
assertTrue(helper.sorted(ys));
sorter.postProcess(ys);
final int compares = (int) statPack.getStatistics(InstrumentedHelper.COMPARES).mean();
assertEquals(expected: list.size() - 1, compares);
final int inversions = (int) statPack.getStatistics(InstrumentedHelper.INVERSIONS).mean();
assertEquals(expected: 0L, inversions);
final int fixes = (int) statPack.getStatistics(InstrumentedHelper.FIXES).mean();
assertEquals(inversions, fixes);
}
@Test
public void sort1() throws Exception {
final List<Integer> list = new ArrayList<>();
list.add(3);
list.add(4);
list.add(2);
Run: InsertionSortTest
Tests passed: 6 of 6 tests – 255 ms
InsertionSortTest (edu.neu.co 255 ms
testMutatingInsertionSort 224 ms
sort0 18 ms
sort1 1 ms
sort2 9 ms
sort3 2 ms
testStaticInsertionSort 1 ms
/Library/Java/JavaVirtualMachines/jdk-17.0.1.jdk/Contents/Home/bin/java ...
2022-02-12 21:09:33 DEBUG Config - Config.get(helper, instrument) = true
2022-02-12 21:09:33 DEBUG Config - Config.get(helper, seed) = 0
2022-02-12 21:09:33 DEBUG Config - Config.get(instrumenting, copies) = true
2022-02-12 21:09:33 DEBUG Config - Config.get(instrumenting, swaps) = true
2022-02-12 21:09:33 DEBUG Config - Config.get(instrumenting, compares) = true
2022-02-12 21:09:33 DEBUG Config - Config.get(instrumenting, inversions) = 1
2022-02-12 21:09:33 DEBUG Config - Config.get(instrumenting, fixes) = true
2022-02-12 21:09:33 DEBUG Config - Config.get(instrumenting, hits) = true
2022-02-12 21:09:33 DEBUG Config - Config.get(helper, cutoff) =
Helper for InsertionSort with 4 elements
Tests passed: 6
Git Run TODO Problems Profiler Terminal Endpoints Build Dependencies
Event Log
Tests passed: 6 (moments ago)
46:1 LF UTF-8 4 spaces Spring2022