Program Structures and Algorithms
Fall 2022(SEC 06)

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Task:

- Solve 3-SUM using the Quadrithmic, Quadratic and QuadraticWithCalipers approaches
- Use spreadsheet to show timing observations
- Explain why the quadratic method(s) work

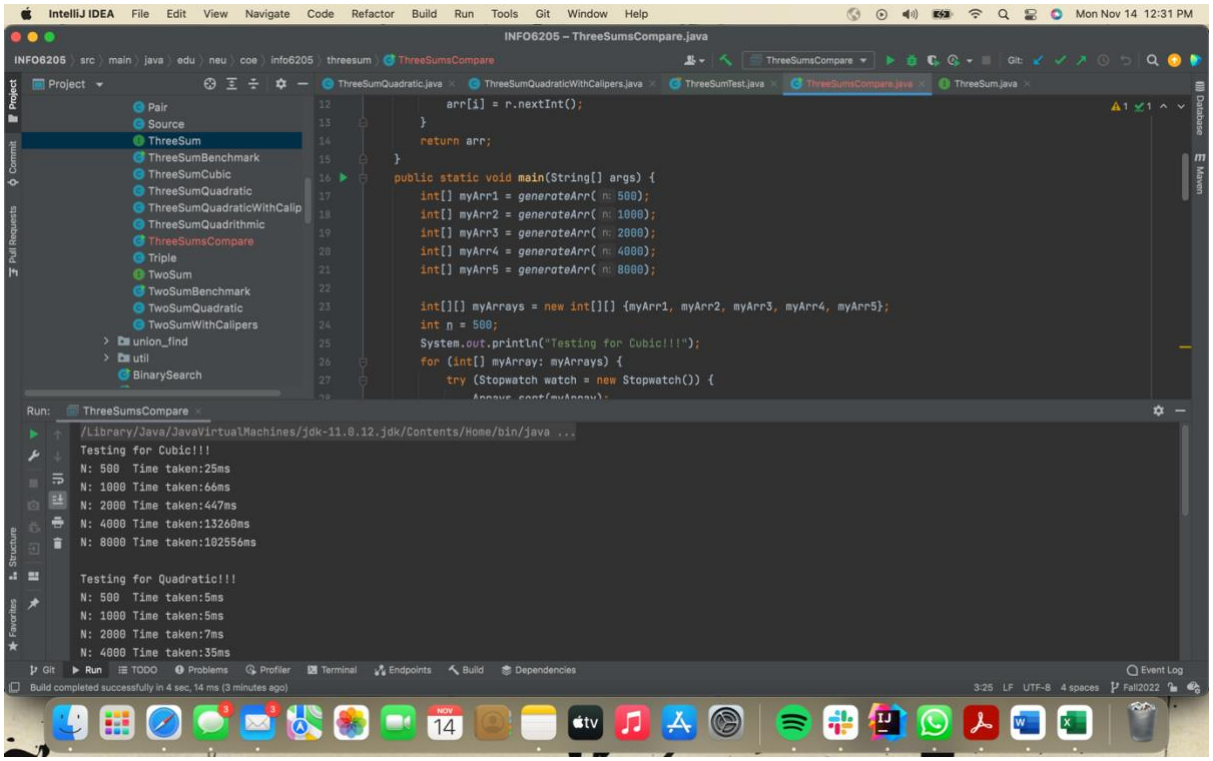
Relationship Conclusion:

The Cubic is the slowest as the time grows exponentially as the input increases, the QuadraticWithCalipers is the fastest, as it is slightly faster than the Quadratic method, you'll start to notice this when the number of inputs increases.

Evidence to support that conclusion:

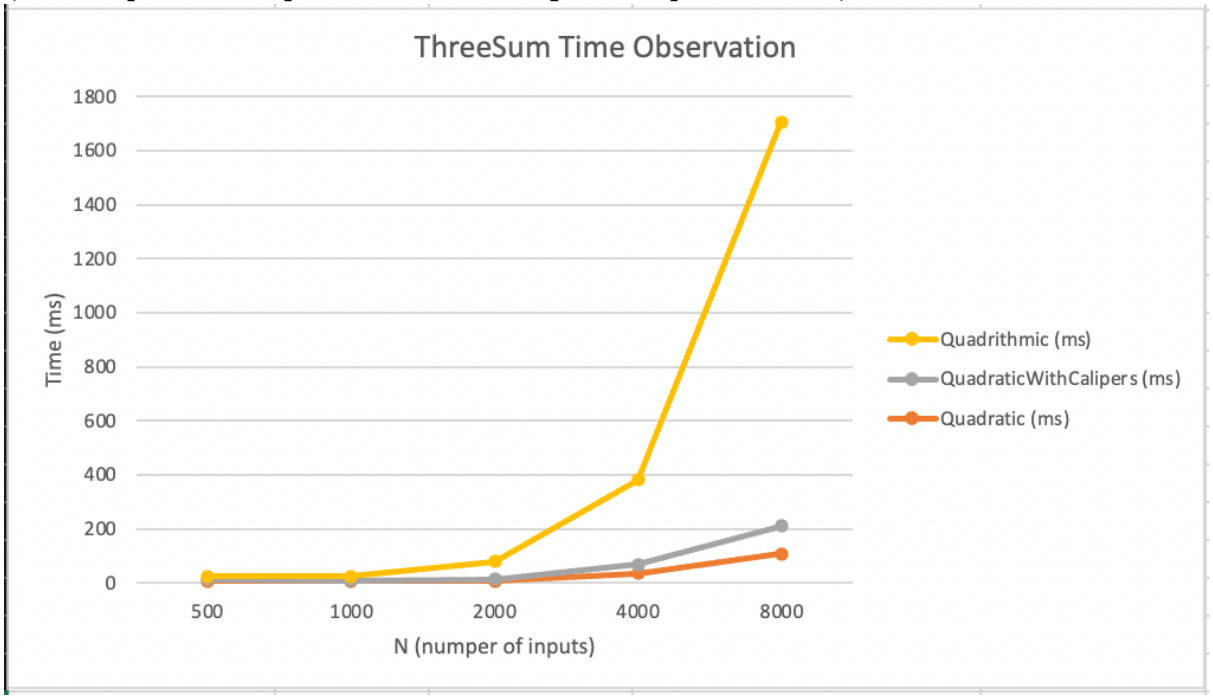
The table shows how the time grows with respect to doubling the number of inputs

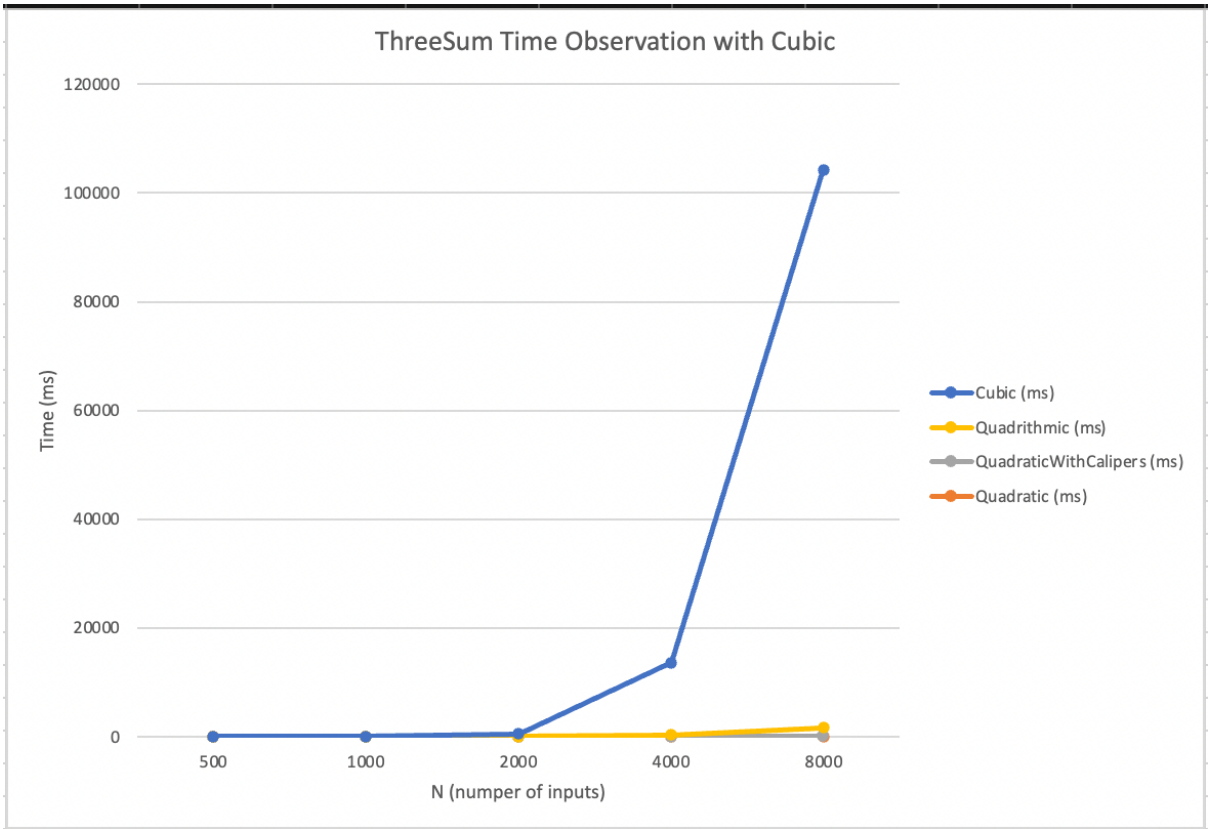
N (number of inputs)	Cubic (ms)	Quadratic (ms)	QuadraticWithCalipers (ms)	Quadrithmic (ms)
500	25	5	8	11
1000	66	5	3	15
2000	447	7	5	67
4000	13260	35	33	312
8000	102556	107	102	1497



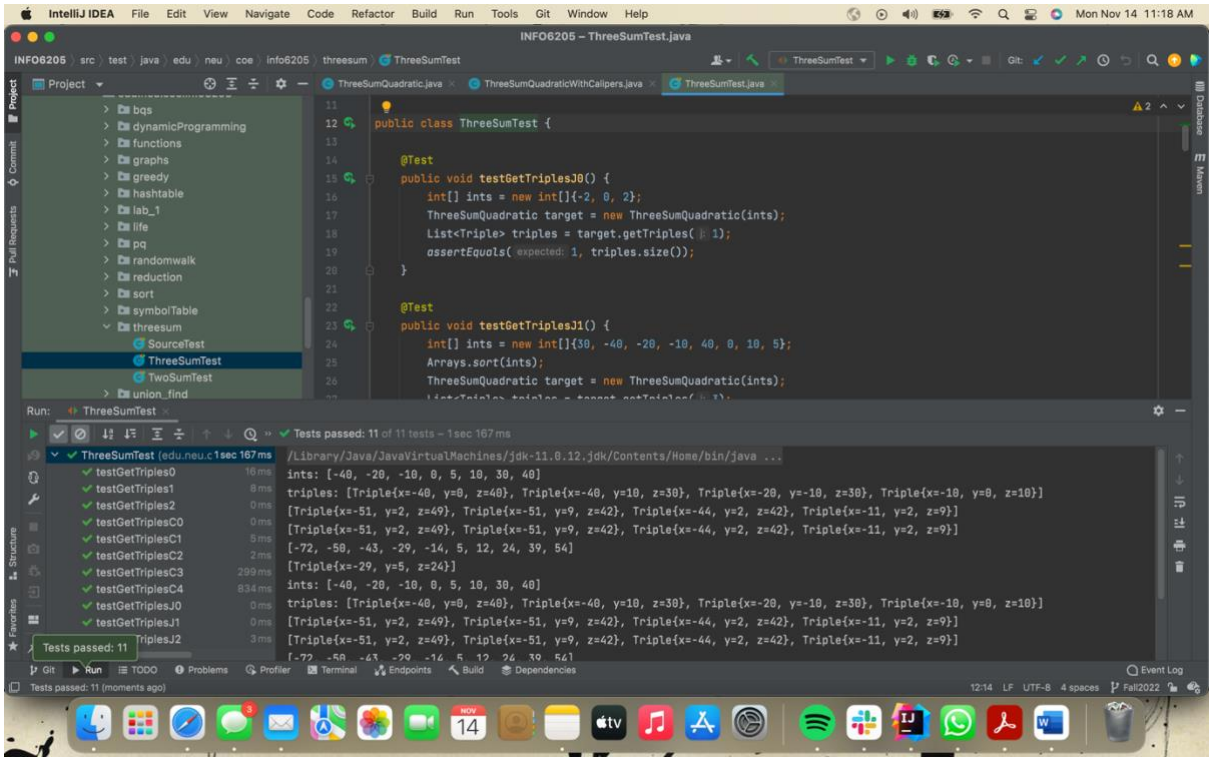
Graphical Representation:

The line graphs below show us how the time it takes to get ThreeSums increases respectively with the number of inputs for each ThreeSum approach used (cubic, quadratic, quadraticWithCalipers & quadrithmic)





Unit Test Screenshots:


IntelliJ IDEA File Edit View Navigate Code Refactor Build Run Tools Git Window Help
Mon Nov 14 11:18 AM
INFO6205 – ThreeSumTest.java
ThreeSumQuadratic.java
ThreeSumQuadraticWithCalipers.java
ThreeSumTest.java
public class ThreeSumTest {
@Test
public void testGetTriplesJ0() {
int[] ints = new int[]{-2, 0, 2};
ThreeSumQuadratic target = new ThreeSumQuadratic(ints);
List<Triple> triples = target.getTriples(j: 1);
assertEquals(expected: 1, triples.size());
}
@Test
public void testGetTriplesJ1() {
int[] ints = new int[]{30, -40, -20, -10, 40, 0, 10, 5};
Arrays.sort(ints);
ThreeSumQuadratic target = new ThreeSumQuadratic(ints);
Run: ThreeSumTest
Tests passed: 11 of 11 tests – 1 sec 167 ms
/Library/Java/JavaVirtualMachines/jdk-11.0.12.jdk/Contents/Home/bin/java ...
ints: [-40, -20, -10, 0, 5, 10, 30, 40]
triples: [Triple{x=-40, y=0, z=40}, Triple{x=-40, y=10, z=30}, Triple{x=-20, y=-10, z=30}, Triple{x=-10, y=0, z=10}]
[Triple{x=-51, y=2, z=49}, Triple{x=-51, y=9, z=42}, Triple{x=-44, y=2, z=42}, Triple{x=-11, y=2, z=9}]
[Triple{x=-51, y=2, z=49}, Triple{x=-51, y=9, z=42}, Triple{x=-44, y=2, z=42}, Triple{x=-11, y=2, z=9}]
[-72, -58, -43, -29, -14, 5, 12, 24, 39, 54]
[Triple{x=-29, y=5, z=24}]
ints: [-40, -20, -10, 0, 5, 10, 30, 40]
triples: [Triple{x=-40, y=0, z=40}, Triple{x=-40, y=10, z=30}, Triple{x=-20, y=-10, z=30}, Triple{x=-10, y=0, z=10}]
[Triple{x=-51, y=2, z=49}, Triple{x=-51, y=9, z=42}, Triple{x=-44, y=2, z=42}, Triple{x=-11, y=2, z=9}]
[Triple{x=-51, y=2, z=49}, Triple{x=-51, y=9, z=42}, Triple{x=-44, y=2, z=42}, Triple{x=-11, y=2, z=9}]
Tests passed: 11
Tests passed: 11 (moments ago)