

# INFO 6205 Program Structures and Algorithms Fall 2022(SEC 06)

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**Task: Using 3 approaches: Quadrithmic, quadratic and quadratic with calipers to solve thresum problem.**

**Unit Tests:**

```
public class ThreeSumTest {  
    @Test  
    public void testGetTriples0() {  
        int[] ints = new int[]{-2, 0, 2};  
        ThreeSumQuadratic target = new ThreeSumQuadratic(ints);  
        List<Triple> triples = target.getTriples(1);  
        assertEquals("expected 1, triples.size()",  
            1, triples.size());  
    }  
  
    @Test  
    public void testGetTriples1() {  
        int[] ints = new int[]{-10, -40, -20, -10, 40, 0, 10, 5};  
        Arrays.sort(ints);  
        ThreeSumQuadratic target = new ThreeSumQuadratic(ints);  
        List<Triple> triples = target.getTriples(5);  
        assertEquals("expected 2, triples.size()",  
            2, triples.size());  
    }  
  
    @Test  
    public void testGetTriples2() {  
        Supplier<int[]> intsSupplier = new Source(10, 10, 15, 20).intsSupplier(10);  
        int[] ints = intsSupplier.get();  
        ThreeSumQuadratic target = new ThreeSumQuadratic(ints);  
        List<Triple> triples = target.getTriples(5);  
        assertEquals("expected 1, triples.size()",  
            1, triples.size());  
    }  
}
```

Run: ThreeSumTest  
Tests passed: 11 of 11 tests - 1sec 914ms  
testGetTriples0 10ms  
testGetTriples1 10ms  
testGetTriples2 10ms  
testGetTriplesC0 6ms  
testGetTriplesC1 6ms  
testGetTriplesC2 10ms  
testGetTriplesC3 10ms  
testGetTriplesC4 10ms  
testGetTriplesJ0 0ms  
testGetTriplesJ1 0ms  
testGetTriplesJ2 0ms  
Tests passed: 11  
Tests passed 11 (moments ago)

**Run result:**

```
ThreeSumBenchmark: N=250  
2022-10-03 01:45:42 INFO Benchmark_Timer - Begin run: ThreeSumQuadratic with 100 runs  
2022-10-03 01:45:43 INFO TimeLogger - Raw time per run (nSec): .43  
2022-10-03 01:45:43 INFO TimeLogger - Normalized time per run (n^2 log n): 10.68  
2022-10-03 01:45:43 INFO Benchmark_Timer - Begin run: ThreeSumCubic with 100 runs  
2022-10-03 01:45:43 INFO TimeLogger - Raw time per run (nSec): 1.38  
2022-10-03 01:45:43 INFO TimeLogger - Normalized time per run (n^2 log n): 2.77  
2022-10-03 01:45:43 INFO Benchmark_Timer - Begin run: ThreeSumQuadrithmic with 100 runs  
2022-10-03 01:45:43 INFO TimeLogger - Raw time per run (nSec): 9.45  
2022-10-03 01:45:43 INFO TimeLogger - Normalized time per run (n^3): .60  
ThreeSumBenchmark: N=1000  
2022-10-03 01:45:45 INFO Benchmark_Timer - Begin run: ThreeSumQuadratic with 50 runs  
2022-10-03 01:45:45 INFO TimeLogger - Raw time per run (nSec): 1.68  
2022-10-03 01:45:45 INFO TimeLogger - Normalized time per run (n^2 log n): 6.72  
2022-10-03 01:45:45 INFO Benchmark_Timer - Begin run: ThreeSumCubic with 50 runs  
2022-10-03 01:45:45 INFO TimeLogger - Raw time per run (nSec): 5.64  
2022-10-03 01:45:45 INFO TimeLogger - Normalized time per run (n^2 log n): 2.52  
2022-10-03 01:45:45 INFO Benchmark_Timer - Begin run: ThreeSumQuadrithmic with 50 runs  
2022-10-03 01:45:45 INFO TimeLogger - Raw time per run (nSec): 21.92  
2022-10-03 01:45:45 INFO TimeLogger - Normalized time per run (n^3): .59  
ThreeSumBenchmark: N=2000  
2022-10-03 01:45:54 INFO Benchmark_Timer - Begin run: ThreeSumQuadratic with 20 runs  
2022-10-03 01:45:54 INFO TimeLogger - Raw time per run (nSec): 5.70  
2022-10-03 01:45:54 INFO TimeLogger - Normalized time per run (n^2 log n): 5.70  
2022-10-03 01:45:54 INFO Benchmark_Timer - Begin run: ThreeSumCubic with 20 runs  
2022-10-03 01:45:54 INFO TimeLogger - Raw time per run (nSec): 23.90  
2022-10-03 01:45:54 INFO TimeLogger - Normalized time per run (n^2 log n): 2.48  
2022-10-03 01:45:54 INFO Benchmark_Timer - Begin run: ThreeSumQuadrithmic with 20 runs  
2022-10-03 01:45:54 INFO TimeLogger - Raw time per run (nSec): 580.28  
2022-10-03 01:45:54 INFO TimeLogger - Normalized time per run (n^3): .58  
ThreeSumBenchmark: N=4000  
2022-10-03 01:46:19 INFO Benchmark_Timer - Begin run: ThreeSumQuadratic with 10 runs  
2022-10-03 01:46:19 INFO TimeLogger - Raw time per run (nSec): 24.18  
2022-10-03 01:46:19 INFO TimeLogger - Normalized time per run (n^2 log n): 6.53  
2022-10-03 01:46:19 INFO Benchmark_Timer - Begin run: ThreeSumCubic with 10 runs  
2022-10-03 01:46:19 INFO TimeLogger - Raw time per run (nSec): 109.38  
2022-10-03 01:46:19 INFO TimeLogger - Normalized time per run (n^2 log n): 2.29  
2022-10-03 01:46:19 INFO Benchmark_Timer - Begin run: ThreeSumQuadrithmic with 10 runs  
2022-10-03 01:46:19 INFO TimeLogger - Raw time per run (nSec): 4402.80  
2022-10-03 01:46:19 INFO TimeLogger - Normalized time per run (n^3): .58
```

Graph:

red: cubic

blue: quadrithmic

orange: quadratic

