**INFO6205 31514 Program Structure & Algorithms SEC 01 Spring 2024**

**Assignment 2:** 3-SUM using the Quadrithmic, Quadratic, and quadraticWithCalipers

**Name: Amrita Nischal**

**NUID: 002839305**

**Test cases screenshots:**

**A screenshot of a computer

Description automatically generated**

**Why the quadratic approaches work?**

Similar time complexities are shown by the Quadratic and Quadratic with Calipers algorithms based on benchmark results in an Excel sheet. To be more precise, the relationship between time complexity that is seen is:

Using calipers, quadratic ≈ quadratic < quadrithmic < cubic

Compared to the Cubic approach, the Quadratic method is more effective because it deliberately removes an extraneous third loop. A sorted array is used in the Quadratic method; the time cost of the first sorting is negligible in comparison to the efficiency gains that follow. Every element in the array is traversed by the algorithm, which marks each one as the middle element for a possible triplet. Then, two pointers are initialized from this middle element's left and right, and their locations are modified according to the sum of the triplets.

Through the use of a more efficient procedure and avoiding the requirement for a third loop, the Quadratic method effectively converts a cubic time complexity into a quadratic. This optimization improves the overall performance of the algorithm and demonstrates its effectiveness when compared to its cubic counterpart.

**Timings with five N values of each algorithm:**

**A screenshot of a computer

Description automatically generated**

Excel sheet added to the same repository with values.

**A screenshot of a computer

Description automatically generatedA screenshot of a computer

Description automatically generated**