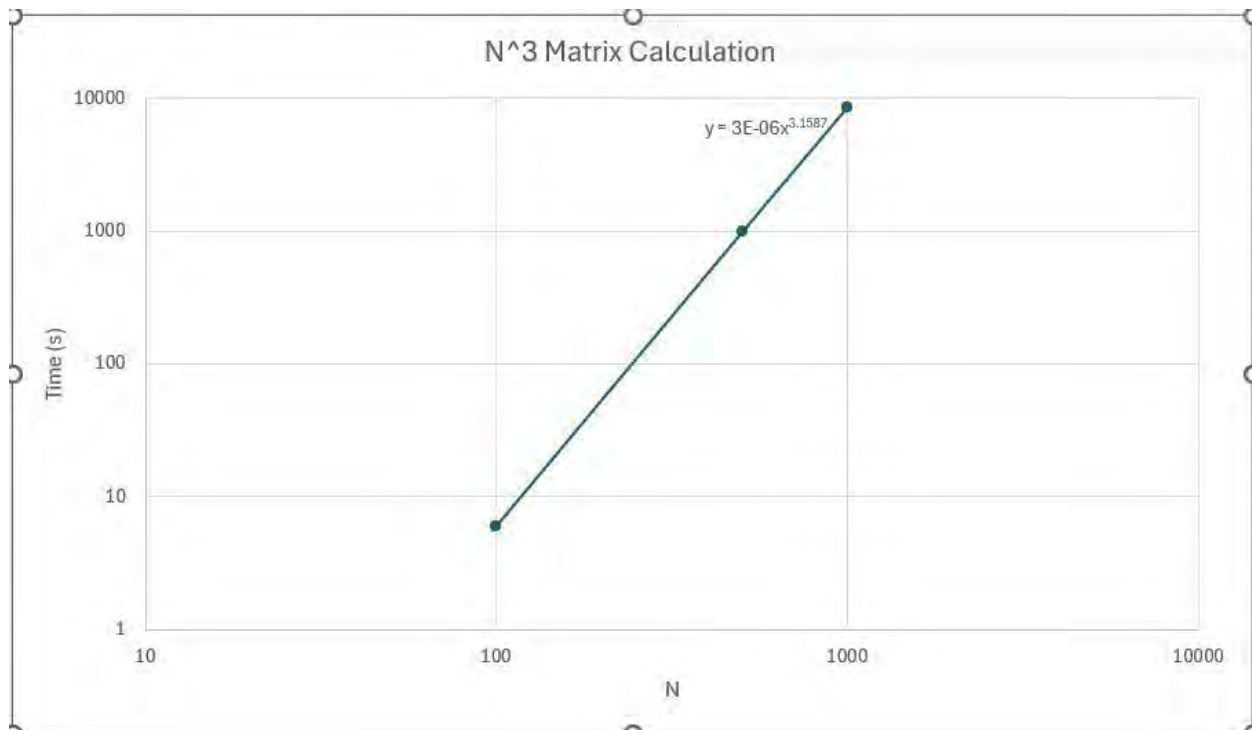## ECE 4822: Engineering Computation IV

## Homework No. 1: Linear Algebra and DSP in C++

Shahzad Khan

## P01: Matrix Multiplication



*P01 Graph*

As we can see with the graph above, I had ran the program, three separate times. With 100x100, 500x500, and 1000x1000 matrices. After collected the times and setting the graph to be log of log, we can see that the graph represents a straight line with the trend line equation being

$$y = 3 * 10^{-6} * N^{3.1587}$$

Which lines up perfectly showing that the time complexity of our program is $O(N^3)$.

Although our equation is a little higher, this could be the result of me only using 3 points so my equation wouldn't be too accurate.

## P02: Autocorrelation Function
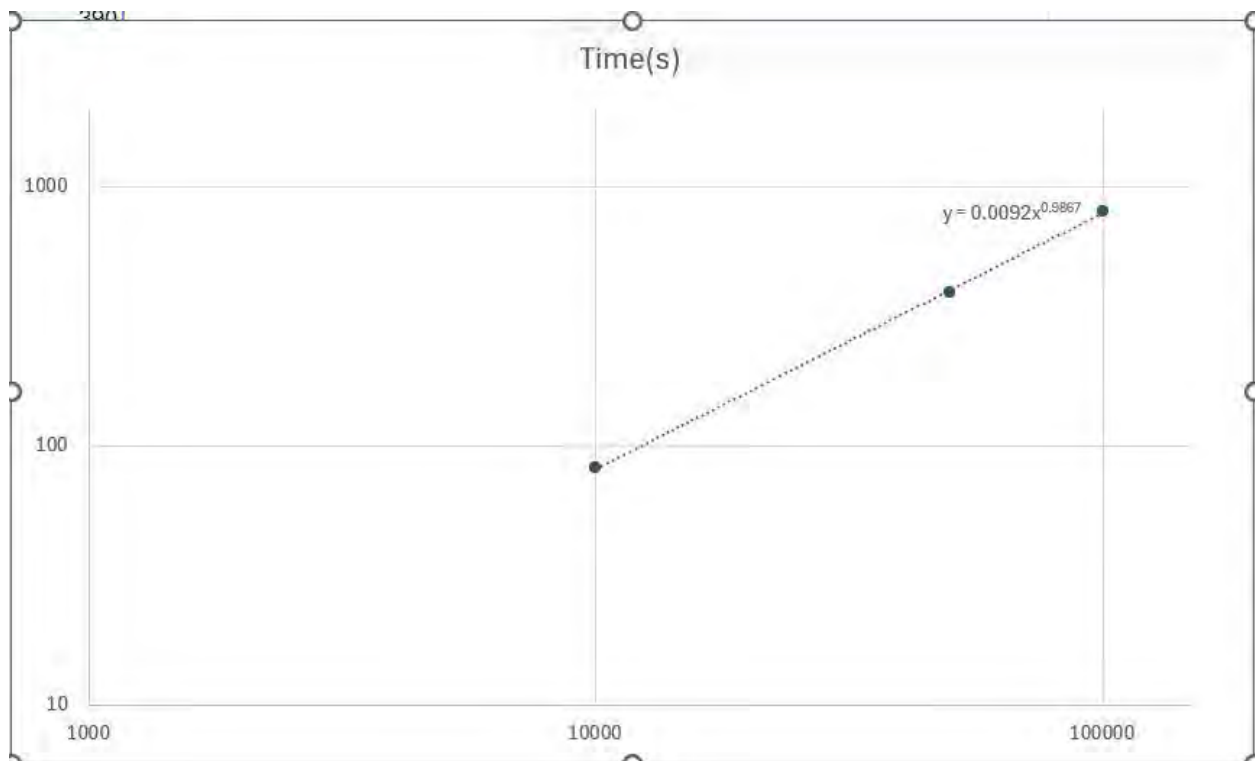


*P02 Graph*

For P02 we generated a random signal and compute the autocorrelation function well measuring its time. As we can see with the graph, I had 3 datapoints at 10,000, 50,000 and 100,000. After graphing using log of log we can see our trendlines equation is

$$y = 0.0092 * N^{0.9867}$$

This indicates a time complexity of simply $O(N)$ This is also the reason why we can run this program with way more iterations that p01 and even have faster times.