MACM 316 - Computing Report #1

David Pham / dhpham@sfu.ca / 301318482

(a) Obtain values $\varepsilon_{res}(N)$ for several values of N.

I chose values

$$N = \{\ n \times 2^4 \mid n \in \mathbb{N}, 1 \leq n \leq 64\ \} \text{ and } N_{ex} = 1000$$

since I started the assignment pretty late. I needed to both compute $\varepsilon_{res}(N)$ and finish this assignment within an hour or two.

I decided on multiples of $2^4 = 16$ since they gave me a decent amount of data points to work with, while also growing at a fast enough rate that would work within my time constraints.

Accuracy, Robustness, and Efficiency

Of course I'd like to have more accuracy by setting a higher bound for n, but Gaussian Elimination grows at $O(n^3)$. Computing a square matrix of size $(64 \times 2^4)^3 = 1024$ takes 1.07×10^9 operations, so if I double the higher bound of n, then the number of operations required to solve a 2048x2048 matrix is increased by a factor of $2^3 = 8$, almost a factor of ten. Solving matrices sized 2048x2048 already takes my computer a few minutes when $N_{ex} = 1000$, so this increased cost is unaffordable.
I try to get around the lack of gargantuan-sized matrices in my dataset by increasing the number of datapoints, and by taking $N_{ex} = 1000$. I've found that this large value of N_{ex} results in a normally distributed sample for any matrix sized $N \times N$.