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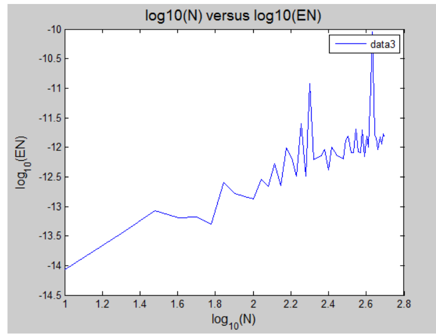
MACM 316 Assignment 2 - Report

(a) **A plot of E_N versus N**

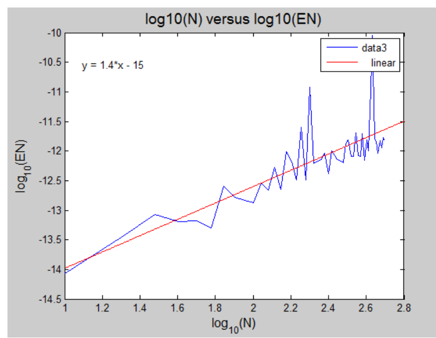


The following image on the right is a plot of $\log_{10}(N)$ versus $\log_{10}(E_n)$ where N is the size of the matrices and E_n is the mean of the error between the exact solution vector x and solution to the linear system z.

The graph has a strong positive relationship. With a larger matrix, the mean error increases correspondingly.

(b) **Justification for the values of N and M you chose.**

As the matrix of size *NxN* becomes increasingly large, the computation time for MATLAB to generate results becomes extremely long, however, that is not the main reason for the choice of my values.



First, I have made a nested FOR-LOOP to compute the mean errors of 10 matrices (as the default), or more at the users' discretion. For example, the size of the matrices are increased by increments of *10x10*, starting at the matrix *10x10* (10x10, 20x20, 30x30, etc.). I will be using the matrices *50x50*, which go up by increments of *50x50* to *500x500*. The mean error E_n is stored in a mean error vector to preserve the values computed by the code.

As stated in (a), the graph has a strong positive relationship. I have tested matrices of size 500, 1000, and 5000 where the mean error E_n only continues to grow at a consistent rate. The value of M improves precision, and have left it at 100 trials.

I chose the value $N = 50$ and increments of 50 to cover more range and precision for the data.

(c) **Explanation of how you do the extrapolation.**

In the graph window, basic fitting in tools, I used a line of best fit (linear/curved) to do the extrapolation. MATLAB provides the user with the equation to the line of best fit, which will be used to estimate when E_n.

(d) **An Estimation of the number N***

For 5 runs of my script: $y=1.2x - 15$, $y = 1.3x -16$, $y=1.2x -14$ were 3 equations of the lines of best fit.

$E_n = 1$, then $\log_{10}(1) = 0$. Using an equation above: $0 = 1.2x -15$ results in $x = 12.5$.

When $b^y = x$ and $\log_b x = y$, then $E_n = 1$ when $N^* = 10^{12.5} =$ **$\underline{3.1622777 \times 10^{12}}$**