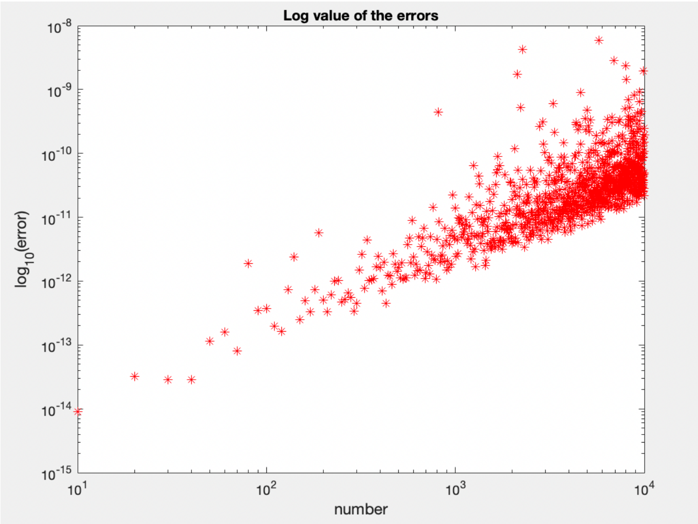
a)



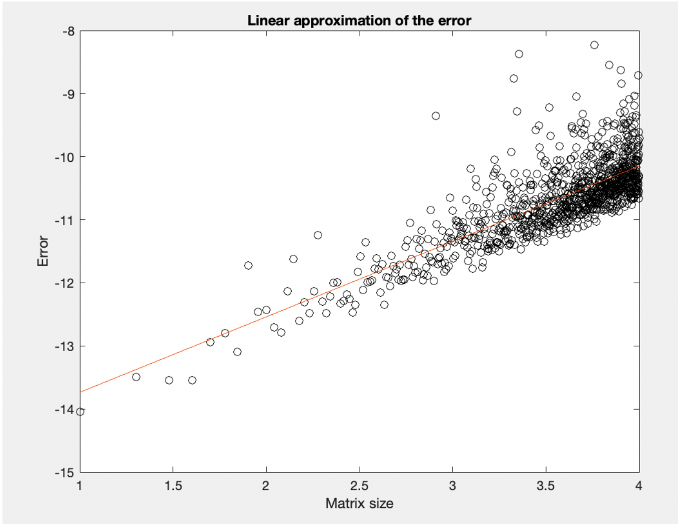


Figure 1

Figure 2

b) I chose N to be values from 10 to 10000 with an increment of 10 so that we have enough data points to have a more accurate linear approximation of the error. It also allowed me to have a big enough end value without making the computation extremely time consuming. The large number of points made it easy to observe the linear pattern in the error. I chose M to be 100 so that we have sufficient trials to improve the accuracy of the linear estimation. I also tried N values that went until 10^5 but the matrix size was too big for Matlab. A lower M (10) value gave me a weaker approximation of the slope and the y-intercept.

c) For different n values from 10 to 10000, random tridiagonal matrices are created and gaussian elimination is used by the backlash command to come up with the solution vector, M times for each n. The max error in each trial is stored and then later used to find the mean error for that n value. Log of the Mean errors of all the n values are then plotted against the respective n value. It can be observed from Figure 1 that the the log error follows a linear pattern. Then, polyfit is used to estimate the slope and the y-intercept of the line. The returned p_1 (1.19563301207961)and p_2(-14.9308145029054) are used in the equation: $1 = \log N^* * p_1 + p_2$; to find the value of N^* where the error in the solution is 1.

D) Polyfit returns 1.19563301207961 and -14.9308145029054 as the slope and the y-intercept. Using,

$y = m \log x + c$

$1 = \log N^* * p_1 + p_2$

$1 = 19563301207961 \log N^* - 14.9308145029054$

$1 = \log N^* * (1.19563301207961) -14.9308145029054$

$\log N^* = 13.32419..$

$N^* = 10^{13.32419..}$

$N* = 2.1095..e13$