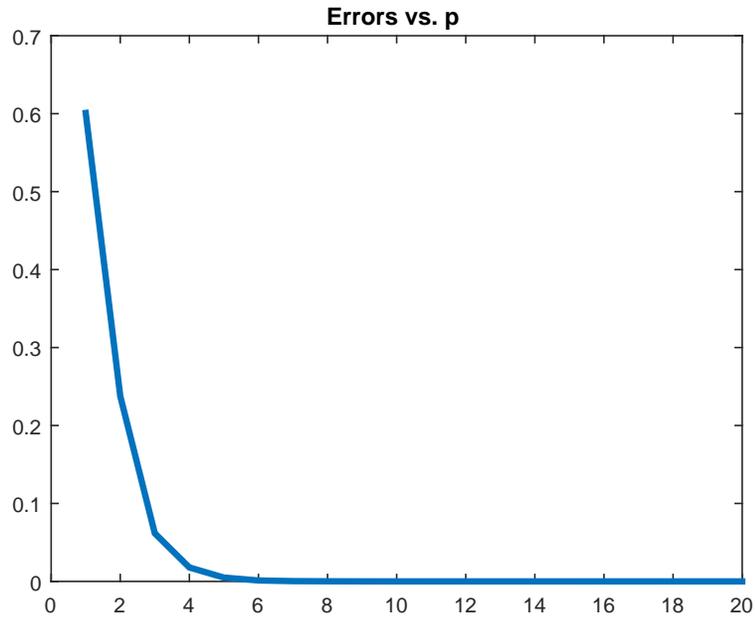


Anna Hoffee – homework 5

Problem 1

(a)

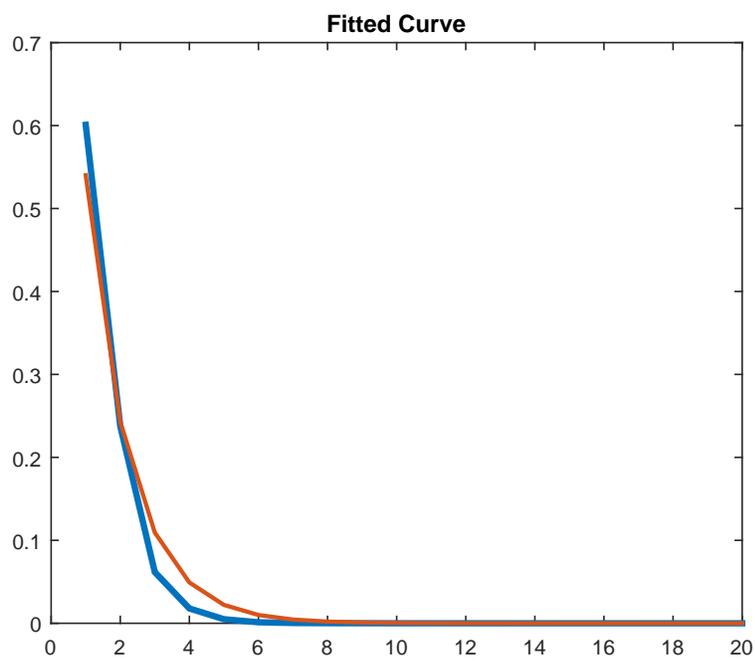
Using the given geometry calculating the error as: $norm(A - real(T_i f_i * T_i f_o * T_o f_s))$ we get the following result:



(b)

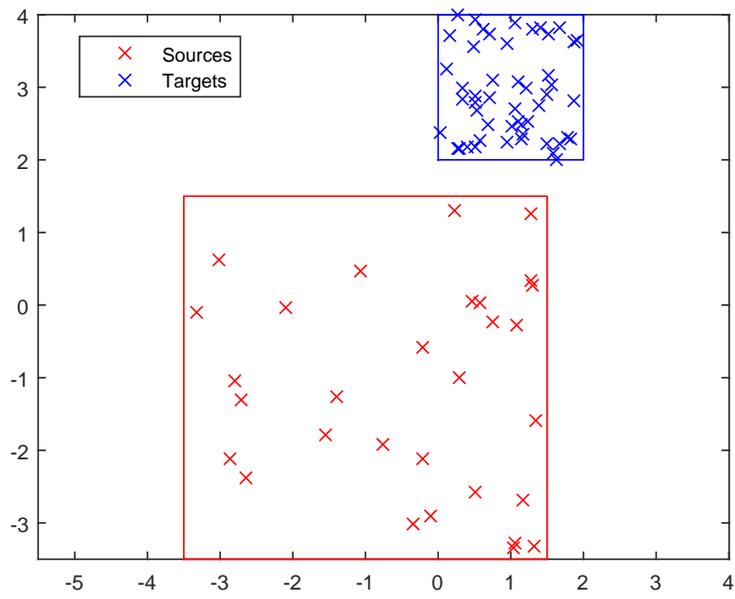
In the graph below, the blue line is the error data and the red line is the fitted function. I found the function using trial and error and the best fit I found was

$$f(p) = 1.2 * .45^p$$



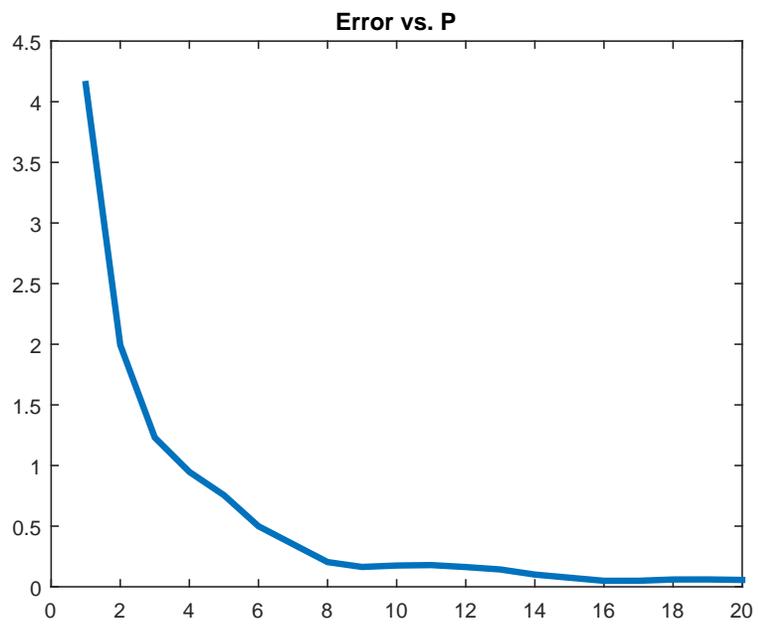
(d)

The following is a picture of the new geometry I chose:



(d)

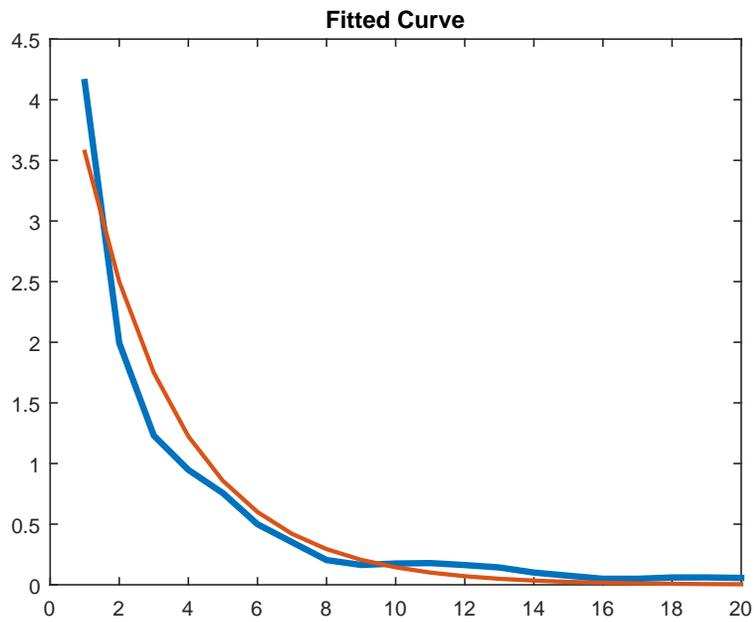
Below is a graph of the errors in the new geometry



When I fit a curve to this plot the closest fit I could find was

$$f(p) = 5.1 * .7^p$$

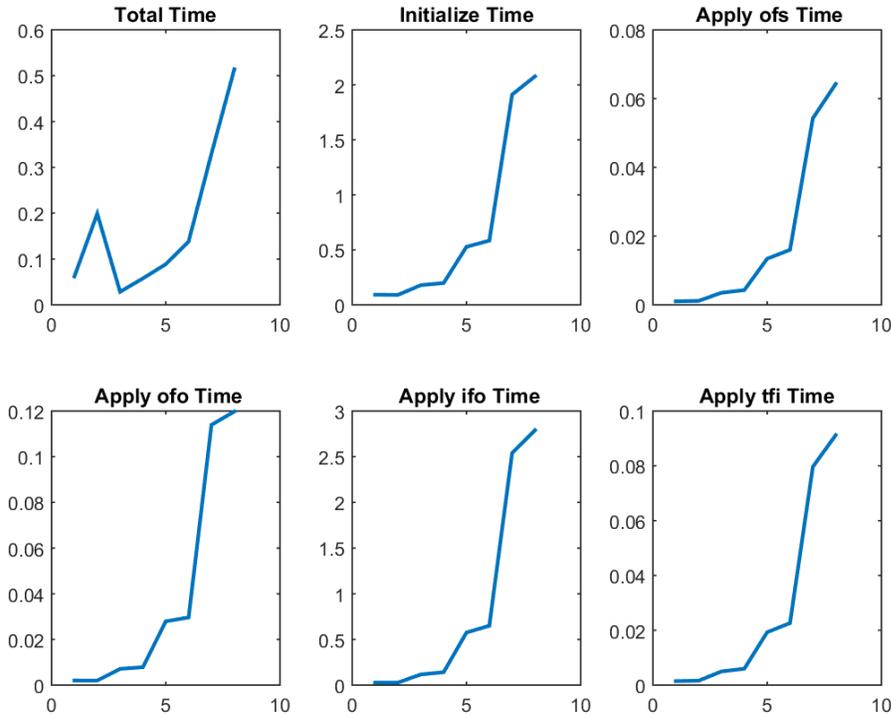
and again the red line is the fitted curve



Problem 2

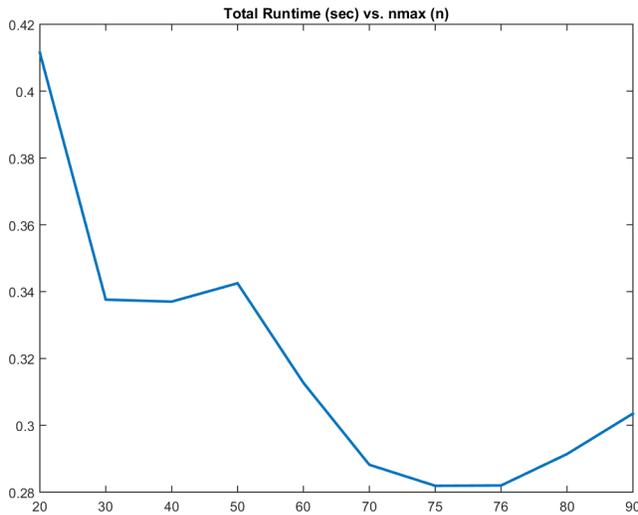
(a)

The graphs below represent time in seconds vs sample size (N). Note that the x axis labels are incorrect. The N values range from 1,000 to 128,000. Computation time tends to increase with sample size. The translation operation computation times were measured by timing how long it took to apply each of the matrices in LOCAL FMM01 apply and summing all the times at the end of the for loop.



(b)

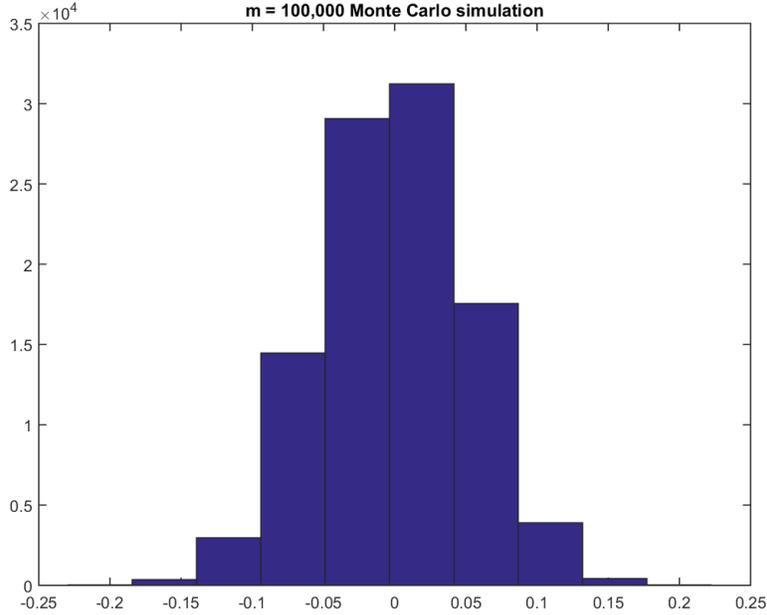
Below is a graph of total runtime (in seconds) for different values of nmax. I found the lowest runtime to be at nmax = 75, I'm assuming this is not just a local minimum.



Problem 3

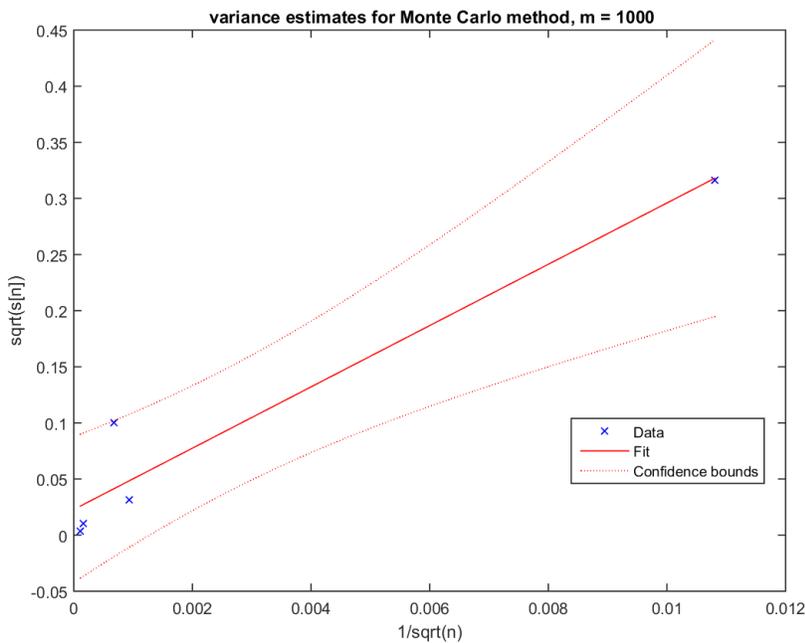
(a)

Just from looking at the histogram of the errors, I would estimate that the errors are normally distributed with mean 0 and variance $\sim .18$



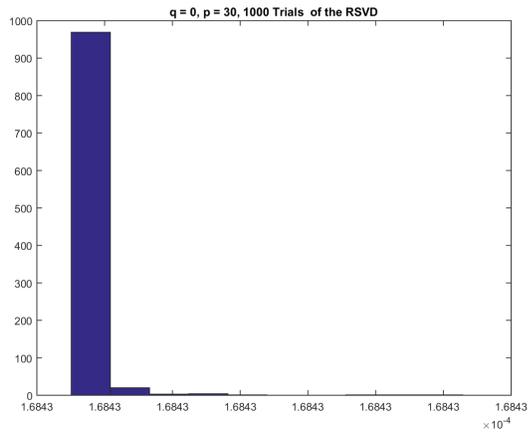
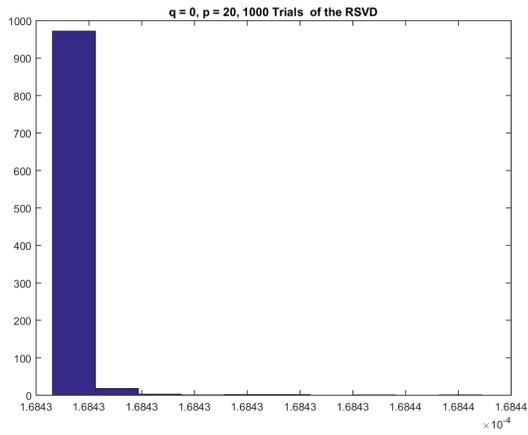
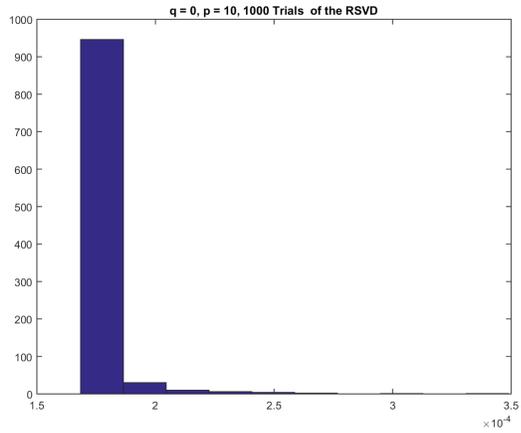
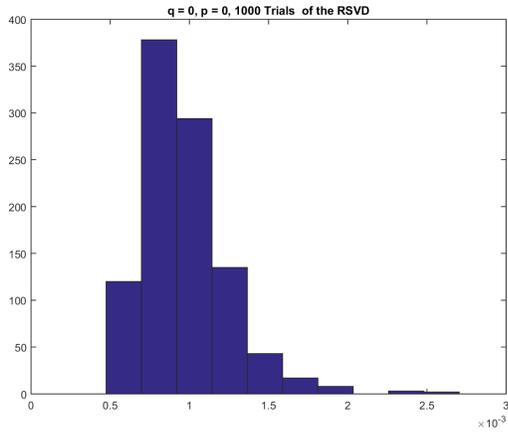
(b)

The graph below is a plot of the \sqrt{s} vs $\frac{1}{\sqrt{n}}$. Analyze how linear this plot is determines if the algorithm scales as predicted. I fit a liner function to the data in matlab to try to determine linerly correlated the variables \sqrt{s} , $\frac{1}{\sqrt{n}}$ are. I would conclude that they are linearly correlated.



(c)

Below are the error histograms for the four different p values. Just by looking at the graphs I would guess that the errors are exponentially distributed with lambda values .9, 1.643, 1.643, 1.643 respectively.



(d)

Now setting $q = 2$ we have for new plots. Just from looking at them I would say that the errors are distributed as an exponential with $\lambda = 1.7$, and the last three are distributed as normal with mean 1.68 and a very low variance.

