Here we have 2 graphs. The first details a scatterplot that has the determinant as the x axis and trace as the y axis. The scatter plot points were created in Intellij through a series of matrix creation. First, 300 2x2 matrices are created through a randomization process. Next, many empty arrays are created to hold the trace, the determinant, and the iterations for the A and A-1 matrices as well. 2 constant variables, tolerance and max iterations are created. They hold the values .000005 and 100 respectively.

All of these values are passed into the power method. This method returns the values that will fill the arrays from before. Next the values are passed into the same method with the matrix a-1 instead. Then, all these values are stored into the arrays before being printed to a text file.

The values passed to the text/csv file were then passed into Microsoft Excel to create these stunning graphs. The colors are determined by how many iterations it took to converge.

This graph shows the relationship between Determinant and trace. The colors are split between 3 categories. 1 iteration, the best, 2-10 iterations, good amount of iterations, and 15-100, a big range for a small amount of values.

This graph also shows the relationship between Determinant and trace. The colors are split between 3 categories. 1 iteration, the best, 2-10 iterations, good amount of iterations, and 12-100, a big range for a small amount of values.

These two graphs have all the same data points. If you look at certain values (the outliers) they are the ones that differ from graph to graph. These graphs have a strong correlation towards the center and then have a point towards the negative determinant. The trace of the graph (when the determinant is negative) does not vary much. The max variations at the point (-6 Determinant). This is because the trace of a matrix is (a11 + a22) and the positivity of a determinant of a matrix directly dependent on those same two points. If the trace is negative, the determinant has to be small (and accordingly close to 0) because the variation of b and c are small in that case as well. This applies to the positive determinant as well. When the determinant is positive, that means that a \* d is larger than b \* c. This gives us a large range for trace since a \* d is positive. These properties give these two graphs the arrowhead shape.

Now we take this matrix A here  
-2 1 2  
0 2 3  
2 1 -2  
and put it through some calculations.

We need two different matrices for the two different scenarios.

1. P1 = -2.5
2. P2 = 2.5

The resulting matrix for p1 is (A-p1I)-1

The resulting matrix for p1 is (A-p2I)-1

After sending these two matrices through the power method, we are given

.7328 as the largest eigenvalue for p1  
-.8333 as the largest eigenvalue for p2

As you can see. The largest eigenvalue using p1 does not converge to (3-p1)-1 but the largest eigenvalue of -2 does converge to that value. When nonlinear problems are considered, errors are introduced in the process of linearization. Thus, it is important to consider not only the matrix of the system, but also some class of perturbed matrices associated with it. Since we are not using these full matrices though are using the max and min to calculate “3”, only the positive value of p2 allows the power method to converge to out expected value.