

## Jacobian Algorithm Program

### The Main Panel

The main panel is where the large bulk of the program will run. To start running the algorithm you can optionally input the level of accuracy and the size of the matrix. If you choose not to customize the size and/or accuracy they will automatically fill in with default<sup>1</sup> values. Next you must choose either with searching or without searching.<sup>2</sup> The searching option will locate the maximum, absolute, off diagonal value to base the 2x2 sub matrix on. The without searching option will systematically build the 2x2 sub matrix from each subsequent value in the upper right triangular matrix. Finally click the *generate* button to randomly fill the matrix and run the jacobian algorithm. When the algorithm has reached the prescribed accuracy, it will display all the results. In panel 1 the original matrix A is displayed along with the final diagonalized matrix. The eigen values are extracted from the diagonal values in the diagonal matrix and displayed in panel 2. Panel 3 displays the sum of the off diagonal values in the matrix A, the sum of the off diagonal values in the diagonal matrix and the trace<sup>3</sup> of the diagonal matrix. Panel 4 displays which mode (*searching/No searching*) the result was found, the total number of iterations it took to reach the diagonal matrix, the time it took to reach the diagonal matrix, and the accuracy at which the diagonal matrix is measured to. If any errors occur during the run of the algorithm, the process will stop and the error and code will display in panel 4.



- Error 1: Matrix is not square
- Error 2: Matrix is not symmetric
- Error 3: 0 matrix found

If you want or need to compare the same matrix, there is an option to save last matrix. Simply click the *save matrix* button and the last matrix A will be saved temporarily into memory. Change the desired settings such as accuracy or mode and click the *use matrix* button to call the matrix saved in memory. The contents in the Matrix A size box will not have an impact on the use of the saved matrix, but they can possibly throw an error if they do not contain values for a square matrix.

<sup>1</sup> By default the algorithm will approximate to an accuracy 10-9 with a 5x5 matrix.

<sup>2</sup> By default the program will use the searching method.

<sup>3</sup> Trace is the sum of the diagonal values in a matrix.

## The Results Panel

The results panel displays all of the usable output data for graphing purposes. The x values are the iteration values. The Y1 values are the  $\log(\text{off}(B))$  relative to each iteration. The Y2 Panel is the theoretical bound. Each of the Y2 values are  $k\ln(9/10)+\ln(\text{off}(A))$  relative to the iterative count( $k$ ). The graph is then comprised of panel 1 vs panel 2 for the actual algorithm and panel 1 vs panel 3 for the theoretical bound.

