2**017 Scientific Computing, Computer Project 5**

Jacobi method for computing eigenvalues

110 points

1. Generate an N by N symmetric matrix as follows:

*void gen\_mtx(double \*\*A, int n){*

*srand(0);*

*for(i=0;i<n;i++)*

*for(j=i;j<n;j++) A[i][j] = A[j][i] = (double)(rand()%50);*

*}*

1. Implement the Jacobi method to compute the eigenvalues and eigenvectors of matrix ***A***.
2. Let N = 4. Compute the eigenvalues and eigenvectors. Then print out these results. (50%).
   1. Matrix ***A*** after the Jacobi procedure converges.
   2. The eigenvalues and the eigenvectors
   3. The norms of , where are eigenvectors and eigenvalues.
   4. Compute  and print the results
3. Let N = 20. Compute the following value after completing an iteration (Given’s rotation)

.

1. Assume *k* iterations have been carried out. Draw a figure to show the decline of *offDiag*. Please print out the eigenvalues too. (20%)
2. Try N= 3, 4, 5, …, 20. Collect the numbers of iterations, *k*, performed in these cases. Draw a figure to show the relation between N and *k*. (20%)
3. It has been proved that Jacobi method enjoys a linear converge rate. However, someone claimed that Jacobi method converges quadratically after some iterations. Based on the test results of 3, 4 and 5, is this claim true? (20%)