Homework Assignment 4
Due on Tuesday 4/22

Programming Problems:

1. Implement Power Iteration(Alg. 27.1), Inverse Iteration(Alg. 27.2) and Rayleigh Quotient Iteration(Alg. 27.3). Use

$$|\lambda^{(k)} - \lambda^{(k-1)}| < Tol$$

as stopping criterion. Tol is the given tolerance. Your code should take a matrix A, a initial vector $v^{(0)}$ and Tol as input for Power Iteration and Rayleigh Quotient Iteration, and take a matrix A, a initial vector $v^{(0)}$, a shift value μ and Tol as input for Inverse Iteration. Your code should assume A is tridiagonal symmetric matrix and use Cholesky decomposition to compute $(A - \mu I)^{-1}$.

Submit your codes through iLMS.

2. Use 20×20 Hilbert matrix H to tests your codes in 1. First reduce the Hilbert matrix H to tridiagonal form T. What are Q and T such that $H = QTQ^t$? Write down Q and T. Use your codes to compute the EW of T. Use initial vector ones(20,1) for all 3 codes and use $\mu = 0$ for Inverse Iteration. Use Matlab build-in function eig to compute the exact EWs of T. Plot the error $\lambda^{(k)} - \lambda_J$ for each iteration, where λ_J is the convergent eigenvalue. Comment on convergence rate.

Writing Problems:

Do the following exercise problems in the text book by Trefethen and Bau,

Exercise 24: 24.1(b, d, e, f. g), 24.2, 24,4(a)

Exercise 25: 25.1, 25.3

Exercise 26: 26.1

Exercise 27: 27.2

Exercise 28: 28.2