**Project 2**
**Due on Wed, Nov 27**

Use Matlab to solve problems below. Submit the results together with your Matlab codes by email. Write your codes from scratch.

1) Consider the symmetric $4 \times 4$ matrix $A$ below. Let us obtain the eigenvalues of $A$ by iterative methods.

$$A = \begin{pmatrix} 20 & 3 & -1 & 1 \\ 3 & 7 & -2 & 2 \\ -1 & -2 & -5 & 1 \\ 1 & 2 & 1 & -8 \end{pmatrix}.$$

Suppose eigenvalues $\lambda_i$ $(i = 1, 2, 3, 4)$ satisfy $\lambda_1 > \lambda_2 > \lambda_3 > \lambda_4$. By the Gerschgorin circle theorem, the eigenvalues satisfy

$$\lambda_{\max} \geq \lambda_1 > \lambda_2 \geq 0 > \lambda_3 > \lambda_4 \geq \lambda_{\min}, \tag{1}$$
$$\lambda_1 > |\lambda_3|, |\lambda_4|.$$

(a) Read page 263 of the textbook. Do you understand the Gerschgorin circle theorem? Answer yes or no.
(b) Find $\lambda_{\max}$ and $\lambda_{\min}$ in (1) using the Gerschgorin circle theorem.
(c) Read §4.2. Do you understand the constant $q$ in the inverse power method? Answer yes or no.
(d) [p. 295, Prob. 21(d)] $\lambda_4$ is smallest but not the dominant eigenvalue. Find $\lambda_4$ with the inverse power method.
(e) Read §4.3. Do you understand Wielandt's deflation and Hotelling's deflation? Answer yes or no.
(f) [p. 308, Prob. 17(d)] Find $\lambda_2$ with Hotelling's deflation.