MA227 (Assignment-8)

1. Modify the code of function *SelfPower.m* in the last assignment in such a way that the function accept the matrix A and initial vector x_0 in sparse (e.g. CRS) format. The main step of power method is the matrix-vector multiplication, perform this operation for sparse matrices and return the eigenvector in the sparse format.

2. Write a function *SelfSD.m* that takes an $n \times n$ symmetric positive definite matrix A, vector $b \in \mathbb{R}^\kappa$, initial vector x_0, integer $maxNumIter$ and positive small number $tol = 10^{-8}$, and returns solution to $Ax = b$. Use steepest descent (SD) method to find the solution and apply the following stopping criteria

   - No. of iteration $k > maxNumIter$ OR
   - $|r_k| \leq tol$.

   Here r_k represents the residual value in the $k-$th iteration.

   For the above two problems, take $A = \begin{bmatrix} 4 & -1 & 0 & 0 & 0 & 0 \\ -1 & 4 & -1 & 0 & 0 & 0 \\ 0 & -1 & 4 & -1 & 0 & 0 \\ 0 & 0 & -1 & 4 & -1 & 0 \\ 0 & 0 & 0 & -1 & 4 & -1 \\ 0 & 0 & 0 & 0 & -1 & 4 \end{bmatrix}$. For the above second

   problem, take $b = \begin{bmatrix} 0 \\ 5 \\ 0 \\ 6 \\ -2 \\ 6 \end{bmatrix}$.