MATH 3423: Adv Linear Alg & Optimization

HomeWork 3

Let A be a (4 x 3) randomly generated matrix

$$\text{A} = \text{np.random.randint(0, 5, size} = (4, 3) \text{)}$$

with integer elements in the interval [0, 5); let b a (4 x 1) randomly generated vector

$$\text{b} = \text{np.random.randint(-1 , 3, size} = (4, 1) \text{)}$$

with integer elements in the interval [-1, 3); and let c a (3 x 1) randomly generated vector

$$\text{c} = \text{np.random.randint(-1 , 3, size} = (3, 1) \text{)}$$

with integer elements in the interval [-1, 3).

1. Find the QR factorizations of A and A^T and use them solve $Ax = b$ and $A^T y = c$.
2. Find the SVD factorizations of A and A^T and use them solve $Ax = b$ and $A^T y = c$.
3. Solve $A^T Ax = A^T b$ using the Cholesky factorization.
4. Solve $A^T Ax = A^T b$ using the QR factorization.
5. Solve $A^T Ax = A^T b$ using the SVD factorization.
6. Find the eigenvalues and the corresponding eigenvectors of $A^T A$ and AA^T.
7. Show numerically that for any rectangular matrix:

$$AA^+A = A \qquad \text{and} \qquad A^+AA^+ = A^+$$

▶ E-Mail Your Work In A Single Jupyter Notebook.