

MATH 313 Spring 2009, Homework 9, Computer-based problems

Consider the matrix A given by

$$A = \begin{pmatrix} 0 & -47 & 56 & 59 & 21 \\ -234 & 136 & -232 & -150 & 2 \\ -122 & -301.4 & 127.2 & 197.8 & 256.2 \\ 120 & -150.8 & 174.4 & 139.6 & 54.4 \\ -142 & -245.4 & 81.2 & 135.8 & 216.2 \end{pmatrix}.$$

Problem 1 Compute the dimensions of the four fundamental subspaces using Matlab. For each, compute a basis, using the fact that the Matlab command “orth(A)” finds a basis for the span of A , and “null(A)” finds a basis for the kernel of A . What is the determinant of A ?

Problem 2 Compute the dimensions of the four fundamental subspaces for A^2 and compute bases. What does this mean about how the range of A and the kernel of A are related?

Problem 3 Compute the rank of A^k for $k = 1, 2, \dots, 25$. What happens? In your explanation, examine how $w = A^k v$ behaves for v a random vector whose entries are between -1 and 1. You should test at least 100 such vectors and organize the output of the tests in some useful way. Hint: normalize the output vector w .