

Step-1

The eigenvalues of a matrix play an important role in application of the matrix.

Step-2

(a)

The objective is to write one significant fact about the Eigen values of real symmetric matrix.

The eigenvalues of a real symmetric matrix are always real.

Step-3

(b)

The objective is to write one significant fact about the Eigen values of a stable matrix.

Stability is governed by the real parts of the Eigen values. All solutions of $\frac{du}{dt} = Au$ approaches to zero if and only if all Eigen values satisfy $\text{Re}(\lambda) < 0$

Hence the Eigen values of a stable matrix are negative if real and real part is negative if complex.

Step-4

(c)

The objective is to write one significant fact about the Eigen values of an orthogonal matrix.

The Eigen values of orthogonal matrix has absolute value 1, $|\lambda| = 1$.

Step-5

(d)

The objective is to write one significant fact about the Eigen values of a Markov matrix.

A Markov matrix: One Eigen value of matrix A is 1, $\lambda_1 = 1$ and other Eigen values satisfy $|\lambda_i| \leq 1$.

Step-6

(e)

The objective is to write one significant fact about the Eigen values of a defective matrix.

A defective matrix: Matrices that cannot be diagonalized are called as defective matrix. **These matrices have repeated Eigen values and corresponding.**

Step-7

(f)

The objective is to write one significant fact about the Eigen values of a singular matrix.

A singular matrix: A singular matrix has determinant zero.

That means the product of eigenvalues is zero and this is possible when at least one eigenvalues is zero.

Hence at least one eigenvalues of the singular matrix is zero.