ME760 Engineering Analysis I

Homework Set 2 due: Monday Sept. 21, 2020

1. For the array

$$\mathbf{C} = \begin{pmatrix} 4 & 6 & 2 \\ 6 & 0 & 3 \\ 2 & 3 & -1 \end{pmatrix}$$

    calculate (a) $\mathbf{C}^2$, (b) $\mathbf{C}^T\mathbf{C}$, and (c) $\mathbf{C}\mathbf{C}^T$.

2. Solve $\mathbf{Ax} = \mathbf{b}$ for the following set of linear equations

$$\begin{pmatrix} 1 & 1 & -1 \\ 0 & 8 & 6 \\ -2 & 4 & -6 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 9 \\ -6 \\ 40 \end{pmatrix}$$

    (a) by Gauss elimination

    (b) by using Cramer's rule

    (c) by finding the inverse $\mathbf{x} = \mathbf{A}^{-1}\mathbf{b}$

3. For each of the sets below determine if the set constitutes a vector space or not. Give your reason for your decision. If you conclude the set is a vector space, determine its dimension and provide a basis.

    (a) all vectors in R^3 satisfying $v_1 - 3v_2 + 2v_3 = 0$ where v_i are the components of a vector $\mathbf{v}$

    (b) all functions $y(x) = a\cos x + b\sin x$ with arbitrary real constants a and b

    (c) all skew-symmetric 2×2 matrices

    (d) all 2×2 matrices with $a_{11} + a_{22} = 0$

    (e) all $m \times m$ matrices with positive elements

4. Find the spectra and eigenvetors for the two matrices below. Show your work.

$$\mathbf{A} = \begin{pmatrix} 3 & 5 & 3 \\ 0 & 4 & 6 \\ 0 & 0 & 1 \end{pmatrix} \qquad \mathbf{A} = \begin{pmatrix} a & 1 & 0 \\ 1 & a & 1 \\ 0 & 1 & a \end{pmatrix}$$