EE2100: Matrix Theory

Assignment - 8

Handed out on 29 - Sep - 2023 **Due on 16 - Oct - 2023 (before 5 PM)**

Instructions :

1. Please submit the solutions to the assignment problems to the course page (on the canvas platform). Solutions submitted to the course page will only be evaluated. Refer to the assignment guidelines mentioned on the course page.

2. Submissions received after the deadline will attract negative marks.

3. It is suggested that you attempt all the questions (preferably the ones indicated using *). However, submitting solutions for problems totaling at least 10 points is sufficient.

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1. *(10 Points) Using a programming Language of your choice, develop a code to compute the coefficients of a polynomial of order n that best approximates the given data. The input to the program must be (a) data in the csv format, where in the first column will be the independent variable and the second column will be the dependent variable/output, and (b) order of the polynomial n.

   Note: The developed code must not use any built-in libraries available in the programming language. Further, for testing the algorithm, you can use the data available here.

2. (5 Points) [1] Prove or disprove the following: The transformation matrix (say $\mathbf{T}$) corresponding to a transformation whose output is the reflection of a vector $\mathbf{x}$ about a given vector $\mathbf{u}$ is orthogonal. Further, compute the inverse of $\mathbf{T}$.

3. (5 Points) Compute the inverse of the matrix $\mathbf{A}$ given by (1) [Refer to Part C of Tutorial 8]

$$\mathbf{A} = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 3 & 2 & 1 & 1 \\ 2 & 1 & 3 & 5 \\ 4 & 3 & 2 & 1 \end{bmatrix} \tag{1}$$

4. (5 Points) Let $\mathbf{A}$ denote the matrix corresponding a transformation that projects a vector $\mathbf{x} \in \mathcal{R}^3$ onto the subspace spanned by $\{\mathbf{e}_1 - \mathbf{e}_2, \mathbf{e}_1 + \mathbf{e}_2\}$ where $\mathbf{e}_1 \in \mathcal{R}^3$ and $\mathbf{e}_2\mathcal{R}^3$ are the standard basis vectors. Compute $\mathbf{A}$ and verify if $\mathbf{A}^2 = \mathbf{I}$.

[1] Adopted from the book "Introduction to Linear Algebra" by Gilbert Strang