EE2100: Matrix Theory

Assignment - 14

Handed out on 19 - Nov - 2023 **Due on 29 - Nov - 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) Compute the condition number of the following matrices.

$$\mathbf{A} = \begin{bmatrix} 1 & 10 & 11 \\ 0 & 10 & 1 \\ 0 & 0 & 10 \end{bmatrix} \text{ and } \mathbf{B} = \begin{bmatrix} 2 & 20 & 22 \\ 0 & 20 & 2 \\ 0 & 0 & 20 \end{bmatrix} \tag{1}$$

   From the above example, conclude if the following statement is True/False. $\mathbf{Cond}(\alpha\mathbf{A}) = \mathbf{Cond}(\mathbf{A}) \forall \alpha \in \mathcal{R}$.

2. (5 Points) Let $T(\mathbf{x}) : \mathcal{R}^2 \to \mathcal{R}^2$ denote a linear transformation corresponding to rotating a vector by θ (in radians) in counterclock wise direction. Compute the condition number of the matrix corresponding to the linear transformation.

3. (5 Points) Let $T(\mathbf{x}) : \mathcal{R}^2 \to \mathcal{R}^2$ denote a linear transformation corresponding to the reflection of a vector about a given vector $\mathbf{v}$. Compute the condition number of the matrix corresponding to the linear transformation.