

Final Assignment

Due Date: 15 Nov 2020

1. Explain the role of matrix algebra in data science.
2. Consider two matrices A and B. Dimensions for both the matrices is $n \times n$. When will the following identity be true: $(A+B)^2 = A^2 + B^2 + 2AB$.
3. $A = \begin{pmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \end{pmatrix}$ $B = \begin{pmatrix} -1 & -3 \\ -5 & 6 \\ 7 & 8 \end{pmatrix}$
 - a. Find AB. Show all the steps.
 - b. Find BA. Show all the steps.
4. Choose one or more names (normal, idempotent, nilpotent or unipotent) for the following matrix
 - a. $\begin{pmatrix} 1 & x \\ 0 & -1 \end{pmatrix}$
5. For the following matrix, calculate the inverse. Show all the steps.
 - a. $\begin{pmatrix} 1 & -3 \\ 5 & -7 \end{pmatrix}$
6. Find the rank of the matrix, eigen values and vectors of the following matrix. Show all the steps.
 - a. $\begin{pmatrix} 1 & 2 & 4 \\ 3 & 8 & 14 \\ 2 & 6 & 13 \end{pmatrix}$
7. Prove $(AB)^{-1} = B^{-1}A^{-1}$
8. Read this article on tensor flow. (<https://machinelearningmastery.com/introduction-to-tensors-for-machine-learning/>). Write a note on what are tensors? How are they different from vectors and matrices? How are they helpful? Discuss one application of tensors where matrices and vectors can't be used.
9. Using LU decomposition, decompose the following matrix in to an upper and a lower triangular matrix. Show all the steps
 - a. $\begin{pmatrix} 1 & 2 & 4 \\ 3 & 8 & 14 \\ 2 & 6 & 13 \end{pmatrix}$