DTSC - 5502 Assignment

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③ showing hand calculations that a defined matrix A and it's inverse A^{-1} gives back the Identity Matrix

given matrix

$$A = \begin{bmatrix} 2 & 3 \\ -1 & 4 \end{bmatrix}$$

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then $A^{-1} = \frac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

$$A^{-1} = \frac{1}{2(4)-(3)(-1)} \begin{bmatrix} 4 & -3 \\ -(-1) & 2 \end{bmatrix}$$

$$= \frac{1}{8-(-3)} \begin{bmatrix} 4 & -3 \\ 1 & 2 \end{bmatrix}$$

$$= \frac{1}{8+3} \begin{bmatrix} 4 & -3 \\ 1 & 2 \end{bmatrix}$$

$$= \frac{1}{11} \begin{bmatrix} 4 & -3 \\ 1 & 2 \end{bmatrix}$$

$$\boxed{A^{-1} = \begin{bmatrix} 4/11 & -3/11 \\ 1/11 & 2/11 \end{bmatrix}}$$

calculating $A.A^{-1}$.

$$A.A^{-1} = \begin{bmatrix} 2 & 3 \\ -1 & 4 \end{bmatrix} \cdot \begin{bmatrix} 4/11 & -3/11 \\ 1/11 & 2/11 \end{bmatrix}$$

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, $A^{1} = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$ then

$$A.A^{-1} = \begin{bmatrix} (a\times p)+(b*r) & (a*q)+(b*s) \\ (b*p)+(d*r) & (b*q)+(d*s) \end{bmatrix}$$

similarly for given A and calculated A^{-1}

$$A.A^{-1} = \begin{bmatrix} (2\times\frac{4}{11}) + 3*\frac{1}{11}) & (2\times -3/11) + (3\times\frac{2}{11}) \\ (-1*\frac{4}{11}) + (4*\frac{1}{11}) & (-1\times\frac{-3}{11}) + (4\times\frac{2}{11}) \end{bmatrix}$$

$$= \begin{bmatrix} 8/11 + \frac{3}{11} & -6/11 + \frac{6}{11} \\ \frac{-4}{11} + \frac{4}{11} & \frac{3}{11} + \frac{8}{11} \end{bmatrix}$$

$$= \begin{bmatrix} 11/11 & 0 \\ 0 & 11/11 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$ which is identity matrix I

Hence proved that $A.A^{-1} = I$