UNIVERSIDAD POLITÉCNICA PUERTO RICO

Computer Science

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Numerical analysis for computer science mayors

FA 2024 CS3010-80

Problems:

1. For the following matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 1 \\ 2 & 1 & 2 \end{bmatrix}$

a) Find the transpose.

b) Find The determinant

Problem 1:

a) $A^T = \begin{bmatrix} 2 & 3 & 2 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix}$

b)

$\det(A) = 2(2\cdot2-1\cdot1) - 1[(3\cdot2)-(1\cdot2)] + 1[(3\cdot1)-(2\cdot2)]$

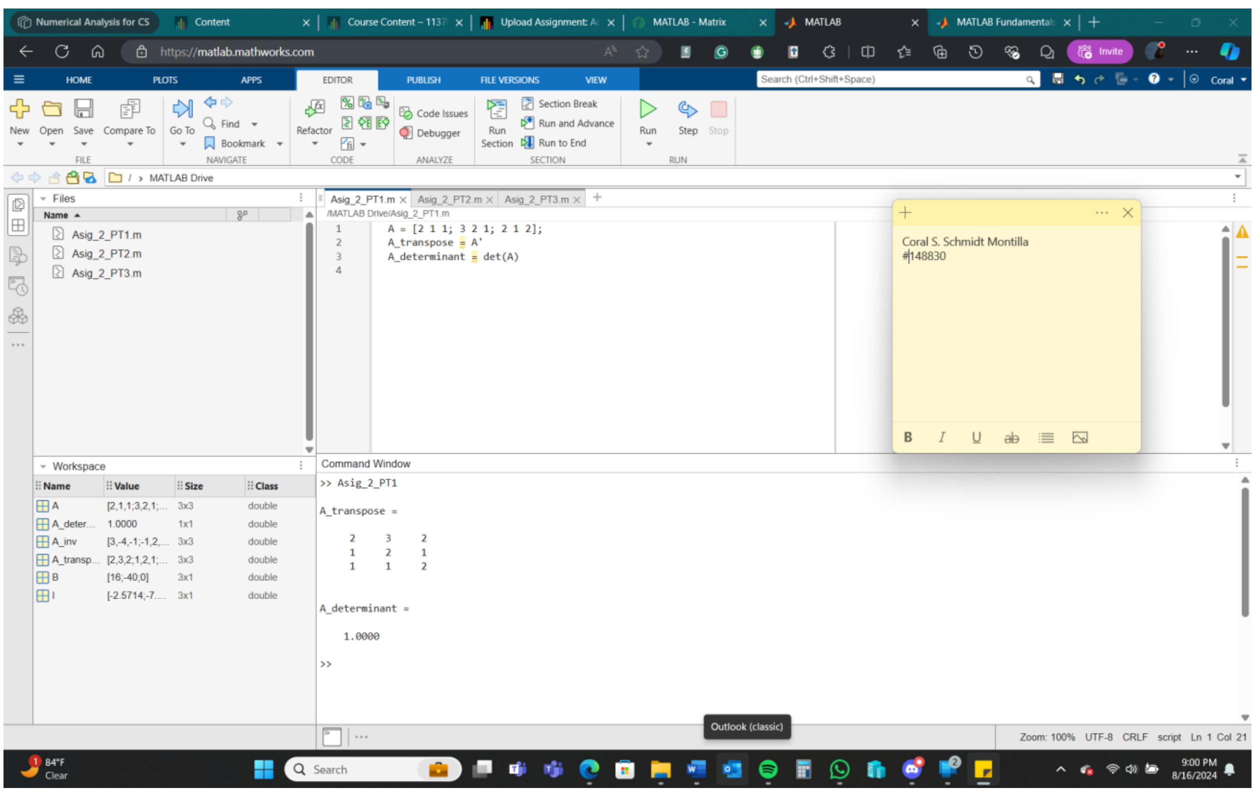
$2[4-1] - 1[6-2] + 1[3-4]$

$2\cdot3 - 1\cdot4 + 1\cdot(-1)$

$6-4-1$

$\boxed{1}$

2. Access the following Tutorial on matrices MATLAB - Matrix using MATLAB and corroborate your previous problems solution using MATLAB. Add to the pdf file the MATLAB output for each of the problems.



3. Find, by hand, the inverse for the following matrix using $A^{-1} = \frac{1}{\det(A)}\, adj(A)$.

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

Problem 3:

$$C = \begin{bmatrix} \det\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix} & -\det\begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix} & \det\begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix} \\ -\det\begin{bmatrix} 3 & 2 \\ 1 & 2 \end{bmatrix} & \det\begin{bmatrix} 2 & 2 \\ 1 & 2 \end{bmatrix} & -\det\begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix} \\ \det\begin{bmatrix} 3 & 2 \\ 2 & 1 \end{bmatrix} & -\det\begin{bmatrix} 2 & 2 \\ 1 & 1 \end{bmatrix} & \det\begin{bmatrix} 2 & 3 \\ 1 & 1 \end{bmatrix} \end{bmatrix}$$

$$C = \begin{bmatrix} 4-1 & -(2-1) & 1-2 \\ -(6-2) & 4-2 & -(2-3) \\ (3-4) & -(2-2) & 2-3 \end{bmatrix}$$

$$\begin{bmatrix} 3 & -1 & -1 \\ -4 & 2 & 1 \\ -1 & 0 & -1 \end{bmatrix}$$

$$adj(A) = \boxed{\begin{bmatrix} 3 & -4 & -1 \\ -1 & 2 & 0 \\ -1 & 1 & -1 \end{bmatrix}}$$

4. Compute, by hand, the currents i1, i2 and i3 for the following system of equation using Cramer Rule.

$$6i_1 - 2i_2 - 4i_3 = 16$$

$$-2i_1 + 10i_2 - 8i_3 = -40$$

$$-4i_1 - 8i_2 + 18i_3 = 0$$

Problem 4:

$$A = \begin{bmatrix} 6 & -2 & -4 \\ -2 & 10 & -8 \\ -4 & -8 & 18 \end{bmatrix}$$

$$\det(A) = 6[(10\cdot 18)-(-8\cdot -8)] - (-2)[(-2\cdot 18)-(-8\cdot -4)] + (-4)[(-2\cdot -8)-(10\cdot -4)]$$

$$6(180-64)-(-2)(36-32)-4(16+40)$$

$$6(116)+2(-68)-4(56)$$

$$696-136-224$$

$$\boxed{336}$$

$$A_1 = \begin{bmatrix} 16 & -2 & -4 \\ -40 & 10 & -8 \\ 0 & -8 & 18 \end{bmatrix} \quad A_2 = \begin{bmatrix} 6 & 16 & -4 \\ -2 & -40 & -8 \\ -4 & 0 & 18 \end{bmatrix} \quad A_3 = \begin{bmatrix} 6 & -2 & 16 \\ -2 & 10 & -40 \\ -4 & -8 & 0 \end{bmatrix}$$

$$\det(A_1) = 16[(10\cdot 18)-(-8\cdot -8)]-(-2)[(-40\cdot 18)-(-8\cdot 0)]+(-4)[(-40\cdot -8)-(10\cdot 0)]$$

$$16(180-64)-(-2)(-720)-4(320)$$

$$16(116)-1440-1280$$

$$1856-1440+1280$$

$$\boxed{1696}$$

$$\det(A_2) = 6[(-40\cdot 18)-(-8\cdot 0)]-16[(-2\cdot 18)-(-8\cdot -4)]+(-4)[(-2\cdot 0)-(-40\cdot -4)]$$

$$6(-720)-16(-36-32)-4(-160)$$

$$-4320+16(-68)+640$$

$$-4320-1088+640$$

$$\boxed{-2592}$$

$$\det(A_3) = 6[(10\cdot 0)-(-8\cdot -40)]-(-2)[(-2\cdot 0)-(-8\cdot -4)]+16[(-2\cdot -8)-(10\cdot -4)]$$

$$6(0-320)-(-2)(0-32)+16(16+40)$$

$$6(-320)+2(-32)+16(56)$$

$$-1920-64+896$$

$$\boxed{-1088}$$

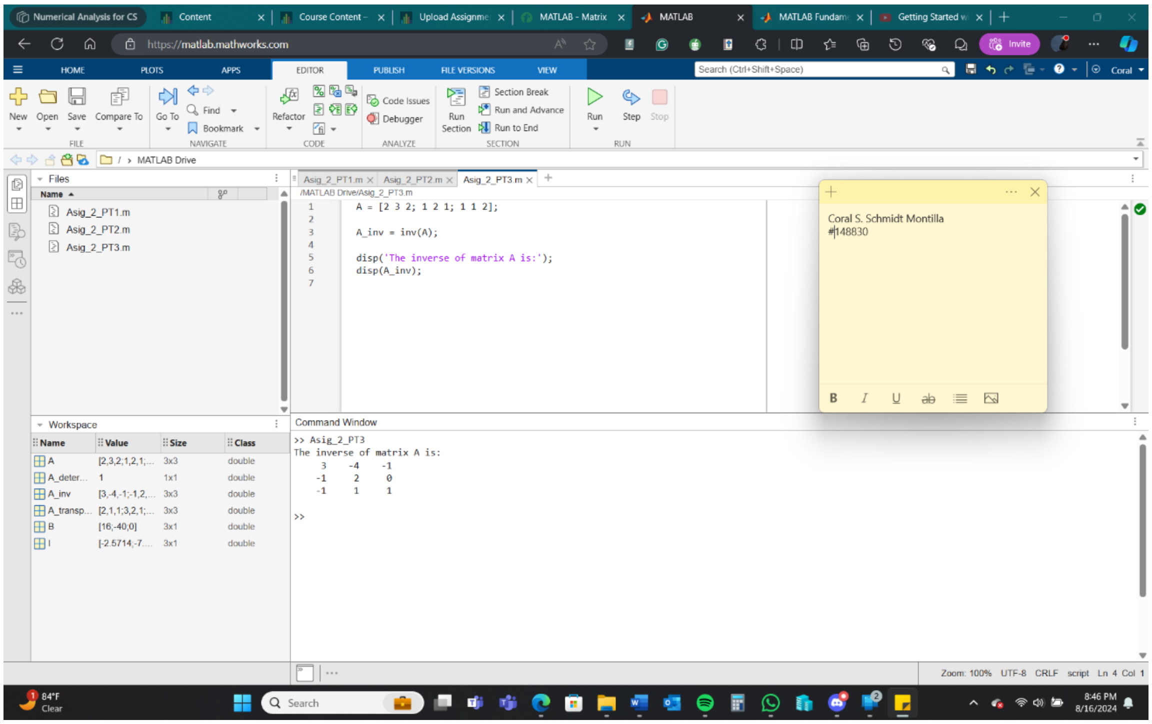
$$i_1 = \frac{1696}{336} = \boxed{-2.5724}$$

$$i_2 = \frac{-2592}{336} = \boxed{-7.7143}$$

$$i_3 = \frac{-1088}{336} = \boxed{-4}$$

5. Access the following tutorial on solving a system of equations using MATLAB Matlab Solves System of Equations to corroborate your previous problems solution using MATLAB. Add to the pdf file the MATLAB output for each of the problems

Problem 3:



Problem 4: