



UNIVERSIDAD  
POLITÉCNICA  
P U E R T O R I C O

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)

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

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

$$2 \cdot 3 - 1 \cdot 4 + 1 \cdot (-1)$$

$$6 - 4 - 1$$

$$1$$

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.

The screenshot shows the MATLAB environment with a script file named 'Asig\_2\_PT1.m' open. The script contains the following code:

```
1 A = [2 1 1; 3 2 1; 2 1 2];
2 A_transpose = A';
3 A_determinant = det(A)
```

The Command Window displays the output of the script:

```
>> Asig_2_PT1
A_transpose =
     2     3     2
     1     2     1
     1     1     2

A_determinant =
     1.0000

>>
```

The Workspace window shows the variables created:

Name	Value	Size	Class
A	[2,1,3,2,1;...]	3x3	double
A_deter...	1.0000	1x1	double
A_inv	[3,-4,-1;1,2;...]	3x3	double
A_transp...	[2,3,2;1,2,1;...]	3x3	double
B	[16,-40,0]	3x1	double
I	[2.5714;-7;...]	3x1	double

A yellow sticky note is placed over the Command Window output, containing the text: "Coral S. Schmidt Montilla #148830".

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

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

Problem 3:

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

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

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

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

4. Compute, by hand, the currents  $i_1$ ,  $i_2$  and  $i_3$  for the following system of equation using Cramer Rule.

$$\begin{aligned} 6i_1 - 2i_2 - 4i_3 &= 16 \\ -2i_1 + 10i_2 - 8i_3 &= -40 \\ -4i_1 - 8i_2 + 18i_3 &= 0 \end{aligned}$$

Problem 4:

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

$$\begin{aligned} \det(A) &= 6[(10 \cdot 18) - (-8 \cdot -8)] - (-2)[(-2 \cdot 18) - (-8 \cdot -4)] + (-4)[(-2 \cdot -8) - (10 \cdot -4)] \\ &= 6(180 - 64) - (-2)(36 - 32) - 4(16 + 40) \\ &= 6(116) + 2(-68) - 4(56) \\ &= 696 - 136 - 224 \\ &= \boxed{336} \end{aligned}$$

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

$$\begin{aligned} \det(A_1) &= 16[(10 \cdot 18) - (-8 \cdot -8)] - (-2)[(-40 \cdot 18) - (-8 \cdot 0)] + (-4)[(-40 \cdot -8) - (10 \cdot 0)] \\ &= 16(180 - 64) - (-2)(-720) - 4(320) \\ &= 16(116) - 1440 - 1280 \\ &= 1856 - 1440 - 1280 \\ &= \boxed{1696} \end{aligned}$$

$$\begin{aligned} \det(A_2) &= 6[(-40 \cdot 18) - (-8 \cdot 0)] - 16[(-2 \cdot 18) - (-8 \cdot -4)] + (-4)[(-2 \cdot 0) - (-40 \cdot -4)] \\ &= 6(-720) - 16(-36 - 32) - 4(-160) \\ &= -4320 + 16(-68) + 640 \\ &= -4320 - 1088 + 640 \\ &= \boxed{-2592} \end{aligned}$$

$$\begin{aligned} \det(A_3) &= 6[(10 \cdot 0) - (-8 \cdot -40)] - (-2)[(-2 \cdot 0) - (-8 \cdot -4)] + 16[(-2 \cdot -8) - (10 \cdot -4)] \\ &= 6(0 - 320) - (-2)(0 - 32) + 16(16 + 40) \\ &= 6(-320) + 2(-32) + 16(56) \\ &= -1920 - 64 + 896 \\ &= \boxed{-1088} \end{aligned}$$

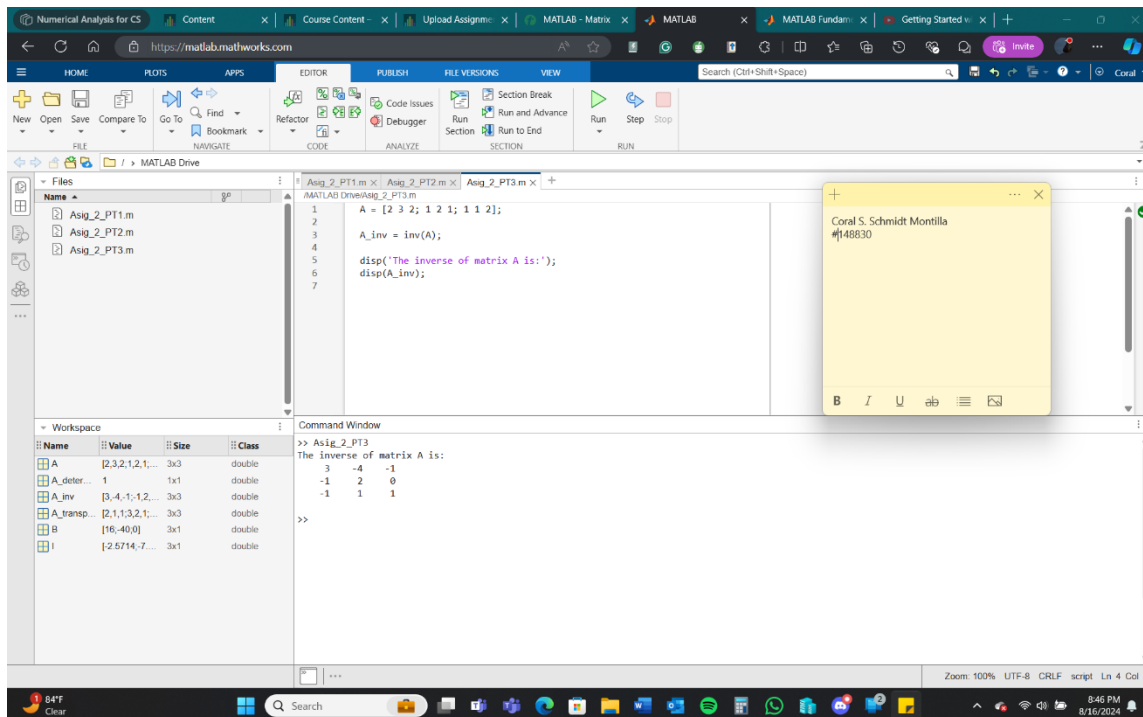
$$i_1 = \frac{1696}{336} = \boxed{-2.5714}$$

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

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

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:

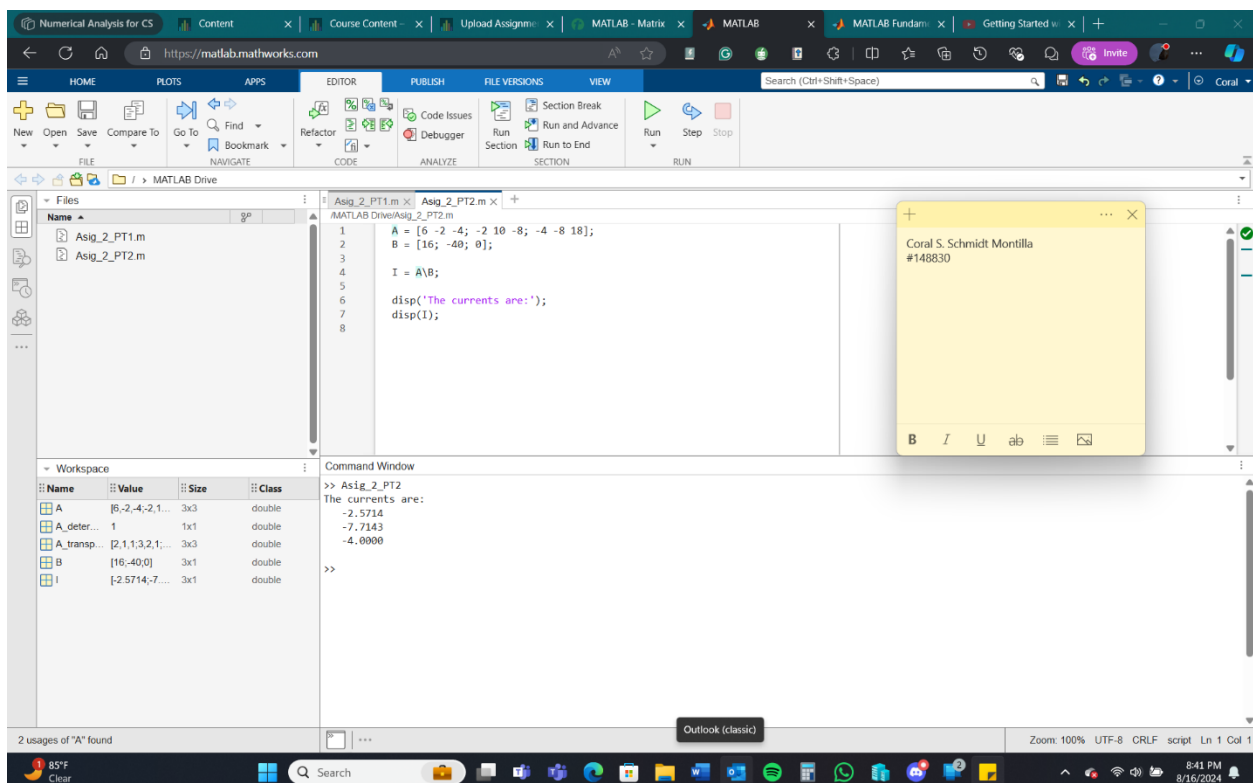


```
1 A = [2 3 2; 1 2 1; 1 1 2];
2
3 A_inv = inv(A);
4
5 disp('The inverse of matrix A is:');
6 disp(A_inv);
7
```

Name	Value	Size	Class
A	[2.3 2.1 2.1...]	3x3	double
A_deter...	1	1x1	double
A_inv	[3.4 -1.1 2...]	3x3	double
A_transp...	[2.1 1.3 2.1...]	3x3	double
B	[16 -40 0]	3x1	double
I	[2.5714 -7...]	3x1	double

```
>> Asig_2_PT3
The inverse of matrix A is:
-1    2    0
-1    1    1
>>
```

### Problem 4:



```
1 A = [6 -2 -4; -2 10 -8; -4 -8 18];
2 B = [16; -40; 0];
3
4 I = A\B;
5
6 disp('The currents are:');
7 disp(I);
8
```

Name	Value	Size	Class
A	[6 -2 -4; -2 10 -8; -4 -8 18]	3x3	double
A_deter...	1	1x1	double
A_transp...	[2.1 1.3 2.1...]	3x3	double
B	[16; -40; 0]	3x1	double
I	[2.5714 -7...]	3x1	double

```
>> Asig_2_PT2
The currents are:
-2.5714
-7.7143
-4.0000
>>
```