

1st MIDTERM

EE510: *LINERAR ALGEBRA FOR ENGINEERING*

SEMESTER: Spring 2020

DATE: Thursday, February 27th , 2020 .

NAME:

USC ID:

SCORE:

PROBLEM	Case1	Case 2	Case 3	Case 4	Case 5
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

Problem 1:

Given the matrix $A = \begin{bmatrix} 1 & 0 & 2 & 0 \\ 0 & 3 & 0 & 1 \\ 1 & 3 & 2 & 1 \end{bmatrix}$ the nullspace $N(A)$ is spanned by:

Case 1	Case 2	Case 3	Case 4	Case 5
$\begin{bmatrix} 4 \\ -2 \\ -1 \\ 6 \end{bmatrix}, \begin{bmatrix} 4 \\ 0 \\ -1 \\ 0 \end{bmatrix}$	$\begin{bmatrix} -1 \\ 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \\ 1 \end{bmatrix}$	$\begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 1 \end{bmatrix}$	$\begin{bmatrix} 2 \\ 0 \\ -1 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \\ 3 \end{bmatrix}$	$\begin{bmatrix} 0 \\ 1 \\ 0 \\ -3 \end{bmatrix}, \begin{bmatrix} -2 \\ 0 \\ 1 \\ 0 \end{bmatrix}$

Problem 2:

Given a 3x5 matrix A different than 0 (zero), the column space $C(A)$ can have as basis:

Case 1	Case 2	Case 3	Case 4	Case 5
$\begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$	$\begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}$	$\begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}$	$\begin{bmatrix} 1 \\ 1 \\ -1 \end{bmatrix}, \begin{bmatrix} 0 \\ -1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$	$\begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \\ 3 \end{bmatrix},$

Problem 3:

What is the rank of the matrix $A = \begin{bmatrix} 2 & -2 & 4 \\ 2 & -2 & 4 \\ 2 & -2 & 4 \end{bmatrix}$?

Case 1	Case 2	Case 3	Case 4	Case 5
3	2	0	1	4

Problem 4:

What is the rank of the matrix $A = \begin{bmatrix} 2 & 1 & 1 & 2 & 6 \\ 0 & 2 & -2 & 7 & 5 \\ 0 & 0 & 1 & 8 & 2 \\ 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$?

Case 1	Case 2	Case 3	Case 4	Case 5
2	3	4	5	6

Problem 5:

What is the determinant of the matrix $A = \begin{bmatrix} 1 & 3 & 3 & 4 \\ 0 & 3 & 3 & 4 \\ 0 & 0 & 3 & 4 \\ 0 & 0 & 0 & 4 \end{bmatrix}$?

Case 1	Case 2	Case 3	Case 4	Case 5
9	36	27	4	0

Problem 6:

Two vectors in R^3 ($a, b \in R^3$) form an angle of 60° . Which one of the following may be true?

Case 1	Case 2	Case 3	Case 4	Case 5
$a^T b = 1$	$a^T b = 6$	$a^T b = 5$	$a^T b = -5$	$a^T b = 1/2$
$\ a\ = 1 = \ b\ $	$\ a\ = 3, \ b\ = 4$	$\ a\ = 2, \ b\ = 3$	$\ a\ = 2, \ b\ = 2.5$	$\ a\ = \ b\ = 1/\sqrt{2}$

Problem 7:

Which of the following vectors could be a projection of “b” on “a”?

Case 1	Case 2	Case 3	Case 4	Case 5
$\begin{bmatrix} 1 \\ 2 \\ 1 \\ 1 \end{bmatrix}$	$\begin{bmatrix} -1 \\ -2 \\ 1 \\ 1 \end{bmatrix}$	$\begin{bmatrix} 2 \\ 1 \\ 3 \\ 1 \end{bmatrix}$	$\begin{bmatrix} -1 \\ -1 \\ 0 \\ 0 \end{bmatrix}$	$\begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}$

Problem 8:

Given $A = \begin{bmatrix} 1 & 3 & 1 \\ 0 & 3 & -1 \\ 0 & 0 & 0 \end{bmatrix}$, could any of the following matrices be an inverse?

Case 1	Case 2	Case 3	Case 4	Case 5
$\begin{bmatrix} 1 & 1/3 & 1 \\ 0 & 1/3 & -1 \\ 0 & 0 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & 3 & 1 \\ 0 & 1/3 & -1 \\ 0 & 0 & 0 \end{bmatrix}$	$\begin{bmatrix} 1 & 0 & 0 \\ 1/3 & 1/3 & 0 \\ 1 & -1 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & -3 \\ 0 & 1/3 \end{bmatrix}$	It does not have an inverse

Problem 9:

Given $A = \begin{bmatrix} 4 & 3 \\ 1 & 10 \end{bmatrix}$, the characteristic polynomial is given by:

Case 1	Case 2	Case 3	Case 4	Case 5
$\lambda^3 + 2\lambda^2 + 20$	$\lambda + 14$	$\lambda^2 + 40\lambda + 37$	$\lambda^2 - 14\lambda + 37$	None of them

Problem 10:

A 3x3 matrix A is symmetric ($A=A'$), real and invertible. Which of the following are possible eigenvalues of A?

Case 1	Case 2	Case 3	Case 4	Case 5
1, -1, 1+j	1, 1, 1-j	2, 1-j, 1+j	1, 2, 3, 4	1, 1, 0

Problem 11:

A 3x3 matrix A has eigenvalues 1, 0 and 4. What's the rank of A?

Case 1	Case 2	Case 3	Case 4	Case 5
3	2	1	0	4

Problem 12:

Given $A = \begin{bmatrix} 1 & 1 & 6 & 0 \\ 0 & -1 & -7 & 5 \\ 0 & 0 & 6 & 0 \\ 0 & 0 & -7 & 5 \end{bmatrix}$ the eigenvalues of A are:

Case 1	Case 2	Case 3	Case 4	Case 5
1, -1, 6, 11	1, 1, -7, 5	1, -1, 5, 6	1, -7, 5, 6	1, -1, 6, 0

Problem 13:

Given a 2x2 real symmetric matrix A , with eigenvalues 1 and 2; which of the following can be eigenvectors of A corresponding to 1 and 2 respectively:

Case 1	Case 2	Case 3	Case 4	Case 5
$\begin{bmatrix} 7 \\ 8 \end{bmatrix}, \begin{bmatrix} 8 \\ 7 \end{bmatrix}$	$\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$	$\begin{bmatrix} 1 \\ 2 \end{bmatrix}, \begin{bmatrix} -2 \\ 1 \end{bmatrix}$	$\begin{bmatrix} 3 \\ 2 \end{bmatrix}, \begin{bmatrix} -4 \\ 6 \end{bmatrix},$	$\begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 2 \\ 0 \end{bmatrix},$