

Your PRINTED name is: _____

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				Grading
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(R02)	T11	2-132	HwanChul Yoo	1
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(R04)	T1	2-131	Fucheng Tan	2
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(R07)	T2	2-146	Leonid Chindelevitch	_____
(R08)	T3	2-146	Steven Sivek	_____
				Total:

Problem 1. Consider the matrix $A = \begin{pmatrix} 1 & 3 \\ 1 & 2 \\ 1 & 1 \end{pmatrix}$.

- (a) Find an orthogonal basis of the column space of the matrix A .
- (b) Find a non-zero vector \mathbf{v} which is orthogonal to the column space of A .
- (c) Does this vector \mathbf{v} belong to one of the four fundamental subspaces of A ? Which subspace? Explain why.
- (d) Find a 3 by 2 matrix Q with $Q^T Q = I$ such that Q has the same column space as the matrix A .

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Problem 2. Let $A = \begin{pmatrix} 2 & -1 \\ 1 & 2 \\ 0 & -1 \end{pmatrix}$, and let $\mathbf{b} = \begin{pmatrix} 0 \\ 0 \\ 6 \end{pmatrix}$.

- (a) What is the projection of \mathbf{b} onto the column space of A ?
- (b) Give an orthogonal basis for each of the four fundamental subspaces of A .
- (c) Use least squares approximation to solve $A\mathbf{x} = \mathbf{b}$.

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Problem 3.

(a) Find the area of the triangle on the plane \mathbb{R}^2 with the vertices $(1, 1)$, $(2, 3)$, $(3, 2)$.

(b) Calculate the determinant of the 4 by 4 matrix

$$A = \begin{pmatrix} 1 & -1 & 0 & 0 \\ -1 & 1 & -1 & 0 \\ 0 & -1 & 1 & -1 \\ 0 & 0 & -1 & 1 \end{pmatrix}$$

(c) Find the inverse of the matrix A from part (b).

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