

# MATH 511 HOMEWORK (ON GRADESCOPE)

SIAMAK YASSEMI

## Homework # 3

Due on Jun 30, 2024, 11:59 PM

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Section 3.1: P148 #7,

Section 3.2: P159 #14,

Section 3.3: P170 #3, #6, P171 #12,

Section 3.4: P187 #15,

Section 3.5: P196 #11,

# 3.1.p148.#07

[chapter].[section].[page].[problem]

7. Find a vector  $x$  orthogonal to the row space of  $A$ , and a vector  $y$  orthogonal to the column space, and a vector  $z$  orthogonal to the nullspace:

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 3 \\ 3 & 6 & 4 \end{bmatrix}.$$

# 3.2.p159.#14

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- 14.** What matrix  $P$  projects every point in  $\mathbf{R}^3$  onto the line of intersection of the planes  $x + y + t = 0$  and  $x - t = 0$ ?

3. Solve  $Ax = b$  by least squares, and find  $p = A\hat{x}$  if

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}, \quad b = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}.$$

**6.** Find the projection of  $b$  onto the column space of  $A$ :

$$A = \begin{bmatrix} 1 & 1 \\ 1 & -1 \\ -2 & 4 \end{bmatrix}, \quad b = \begin{bmatrix} 1 \\ 2 \\ 7 \end{bmatrix}.$$

- 12.** If  $\mathbf{V}$  is the subspace spanned by  $(1, 1, 0, 1)$  and  $(0, 0, 1, 0)$ , find
- (a) a basis for the orthogonal complement  $\mathbf{V}^\perp$ .
  - (b) the projection matrix  $P$  onto  $\mathbf{V}$ .
  - (c) the vector in  $\mathbf{V}$  closest to the vector  $b = (0, 1, 0, -1)$  in  $\mathbf{V}^\perp$ .

# 3.4.p187.#15

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**15.** Find an orthonormal set  $q_1, q_2, q_3$  for which  $q_1, q_2$  span the column space of

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

# 3.5.p196.#11

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11. Compute  $y = F_4 c$  by the three steps of the Fast Fourier Transform if  $c = (1, 0, 1, 0)$ .