

Exercises on projections onto subspaces

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1

$$P = A(A^T A)^{-1} A^T = \begin{bmatrix} 100 \\ 010 \\ 001 \\ 000 \end{bmatrix} \begin{bmatrix} 100 \\ 010 \\ 001 \end{bmatrix} \begin{bmatrix} 1000 \\ 0100 \\ 0010 \\ 0000 \end{bmatrix} = \begin{bmatrix} 1000 \\ 0100 \\ 0010 \\ 0000 \end{bmatrix}.$$

It is a 4 by 4 matrix.

2

$$(I - P)^2 = I^2 + P^2 - 2IP = I + P - 2P = I - P$$

P projects onto the column space of A and from $I - P = \begin{bmatrix} 0000 \\ 0000 \\ 0000 \\ 0001 \end{bmatrix}$, we can see that $I - P$ projects onto the left nullspace of A .