Q4   19CS10071

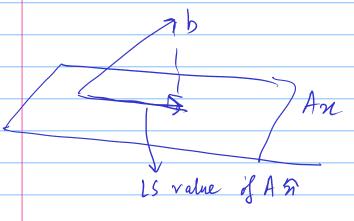$$A: m \times n$$

$$Ax = b \qquad\qquad Ax \Rightarrow \text{Span of the colums of A}.$$

Thus Ax is n dimensional space, since its colums are linearly independent.

Thus the L.S solution to $Ax = b$ can be interpreted as computing the orthogonal projection of b on Ax

LS value of $A\hat{x}$

For optimizing, we take $\nabla \left(\|Ax - b\| \right) = 0$

$$\Rightarrow 2 A^T (Ax - b) = 0$$

$$\Rightarrow A^T A x = A^T b$$

is called normal equation as it gives the normal to the level curve $\|Ax - b\|$ at x

If A does not have L.I columns, then the dimension of Ax will decrease, and we will have multiple solutions to the least square problem, (computed by first removing columns which are L.D on other columns)