

Name (Printed):

Pledge and Sign:

Upload solutions to Gradescope by the due date. Assign solution pages to corresponding problems. You need to pledge and sign on the cover page of your solutions. You may use this page as the cover page.

Legibility, organization of the solution, and clearly stated reasoning where appropriate are all important. Points will be deducted for sloppy work or insufficient explanations.

1. (a) [7 pts.] Find the LDL^T decomposition for the symmetric matrix $S = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 6 & 2 \\ 5 & 2 & 10 \end{bmatrix}$.
- (b) [3 pts.] Show that for any matrix A , the matrix $A^T A$ is a symmetric matrix.

2. [10 pts.] Construct a matrix A whose null space contains the vector $\begin{bmatrix} -7 \\ 4 \\ 1 \end{bmatrix}$, and whose column space contains $\begin{bmatrix} 1 \\ 2 \\ 4 \end{bmatrix}$ and $\begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}$. (If there are many such matrices, any one will do.)

3. Write the complete solution of the following linear system as $\mathbf{x}_p + \mathbf{x}_n$.

$$\begin{array}{rrcr} x & +2y & -z & = 1 \\ 3x & +5y & +2z & = 3 \\ 2x & +y & +13z & = 2 \end{array}$$