

SyDe 312 - Numerical Methods Unit I Linear Systems

Supplementary problems: Cholesky factorization

Find the Cholesky factorization for the given matrix A and use it to solve the linear system $Ax = b$ for the given b vectors:

1. $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 20 & 26 \\ 3 & 26 & 70 \end{bmatrix}$ and

(a) $b = [14 \ 120 \ 265]^T$

(b) $b = [7 \ 38 \ 123]^T$

(c) $b = [10 \ 48 \ 173]^T$

2. $A = \begin{bmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 & 0 & -1 & 0 \\ 1 & 5 & 3 & 1 & 2 & 0 & 1 & 2 & 1 & 2 \\ 1 & 3 & 3 & 1 & 1 & 1 & 2 & 2 & 1 & 2 \\ 1 & 1 & 1 & 5 & 2 & 2 & 1 & 2 & 3 & 2 \\ 0 & 2 & 1 & 2 & 6 & 3 & 2 & 0 & 5 & 4 \\ 0 & 0 & 1 & 2 & 3 & 4 & 2 & 1 & 5 & 3 \\ 1 & 1 & 2 & 1 & 2 & 2 & 7 & 2 & -1 & 4 \\ 0 & 2 & 2 & 2 & 0 & 1 & 2 & 9 & 2 & 5 \\ -1 & 1 & 1 & 3 & 5 & 5 & -1 & 2 & 14 & 4 \\ 0 & 2 & 2 & 2 & 4 & 3 & 4 & 5 & 4 & 7 \end{bmatrix}$ and

(a) $b = [0 \ 8 \ 3 \ -14 \ -39 \ -32 \ -1 \ 45 \ -56 \ -1]^T$

(b) $b = [-15 \ -43 \ -43 \ -27 \ -12 \ -14 \ -59 \ -79 \ 2 \ -63]^T$

(c) $b = [-6 \ -10 \ -8 \ -12 \ -7 \ 0 \ -29 \ -19 \ 24 \ -21]^T$

3. $A = \begin{bmatrix} 9.00 & 18.00 & 36.00 \\ 18.00 & 52.00 & 116.00 \\ 36.00 & 116.00 & 265.25 \end{bmatrix}$ and

(a) $b = [63.00 \ 186.00 \ 417.25]^T$

(b) $b = [-9.00 \ -46.00 \ -113.25]^T$

(c) $b = [81 \ 306 \ 721]^T$