

1. Let $A = [a_1 \ a_2 \ a_3]$ with full rank. Find upper triangular matrices R_1 , R_2 and R_3 such that $AR_1R_2R_3 = [q_1 \ q_2 \ q_3]$ where q_1 , q_2 and q_3 are the orthonormal vectors that obtained from Gram-Schmidt process from a_1 , a_2 and a_3 .

2. Find a unitary transform that maps $\begin{bmatrix} 5 \\ 4 \\ -3 \end{bmatrix}$ to $\begin{bmatrix} 5 \\ -5 \\ 0 \end{bmatrix}$

3. Prove directly that the householder reflector $H = I - 2\frac{v \cdot v^t}{v^t \cdot v}$ is symmetric and unitary if $\|v\| \neq 0$.