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* Given : $M = P_1 L_1 P_2 L_2 U$

$P = P_1 P_2$, $L = P_2^T L_1 P_2 L_2$.

$P^T M = L U$

L.H.S:

$(P_1 P_2)^T (P_1 L_1 P_2 L_2 U)$.

$= P_2^T P_1^T P_1 L_1 P_2 L_2 U$ $[\because (AB)^T = B^T A^T]$.

$= P_2^T I L_1 P_2 L_2 U$ $[\because P^T P = P P^T = I]$.

$= \underbrace{P_2^T L_1 P_2 L_2} U$

L

$= L U$

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