Question 7.1 :

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Substitute ② & ③ in ①.

$$\phi = \alpha_{11} - (\alpha_{11} - \delta_1) - (\alpha_{11} - \varepsilon_1)$$

$$= \delta_1 - \alpha_{11} + \varepsilon_1$$

$$= \delta_1 + \varepsilon_1 - \alpha_{11} \longrightarrow \text{Proved}$$

b) Cost of computing one twisted factorization is $O(n^3)$.

c. Cost of computing all twisted factorization is $O(n^4)$.

7.1: Computing the given $LDL^T x$:

$$\begin{pmatrix} L_{00} D_{00} L_{00}^T & L_{00} D_{00} \lambda_{10} e_L & 0 \\ \lambda_{10} e_L^T D_{00} L_{00}^T & \lambda_{10} e_L^T D_{00} \lambda_{10} e_L + v_{12} e_F^T E_{12} v_{12} e_F & v_{12} e_F^T E_{22} U_{22}^T \\ 0 & U_{22} E_{22} v_{12} e_F & U_{22} E_{22} U_{22}^T \end{pmatrix} * \begin{pmatrix} x_0 \\ \hline x_1 \\ \hline x_2 \end{pmatrix} = \begin{pmatrix} 0 \\ \hline 0 \\ \hline 0 \end{pmatrix} \quad \text{---- (1)}$$

On calculating $\begin{pmatrix} L_{00} & 0 & 0 \\ \lambda_{10} e_L^T & + & V_{12} e_F^T \\ 0 & - & 0 \end{pmatrix}^T \begin{pmatrix} U_{22} \\ \hline X_1 \\ \hline X_2 \end{pmatrix}$

$= \begin{pmatrix} 0 \\ \hline 1 \\ \hline 0 \end{pmatrix}$.

$\therefore X_1 = 1$

From earlier point (A) : on multiplying we get following :

$U_{22} \Sigma_{22} V_{12} e_F X_1 + U_{22} \Sigma_{22} U_{22}^T X_2$

$\Rightarrow X_2 = - U_{22} \Sigma_{22} V_{12} e_F U_{22}^T \Sigma_{22}^T U_{22}$