

LU Decomposition, No pivoting

$$A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1.0001 & 2 \\ 1 & 2 & 2 \end{pmatrix}$$

$$k = 1$$

$$i = 2$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \boxed{\begin{pmatrix} \boxed{1} & 1 & 1 \\ \textcolor{blue}{1} & \textbf{1.0001} & \textbf{2} \\ 1 & 2 & 2 \end{pmatrix}}$$

$$R_2 \leftarrow R_2 - \frac{\textcolor{blue}{1}}{\textcolor{red}{1}} R_1$$

$$\begin{array}{r} \begin{pmatrix} \textbf{1} & \textbf{1.0001} & \textbf{2} \end{pmatrix} \\ -\frac{\textcolor{blue}{1}}{\textcolor{red}{1}} \begin{pmatrix} 1 & 1 & 1 \end{pmatrix} \\ \hline \begin{pmatrix} \textbf{0} & \textbf{0.0001} & \textbf{1} \end{pmatrix} \end{array}$$

$$\begin{pmatrix} 1 & 0 & 0 \\ \textcolor{red}{-1} & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \boxed{\begin{pmatrix} 1 & 1 & 1 \\ \textbf{1} & \textbf{1.0001} & \textbf{2} \\ 1 & 2 & 2 \end{pmatrix}} = \begin{pmatrix} 1 & 1 & 1 \\ \textbf{0} & \textbf{0.0001} & \textbf{1} \\ 1 & 2 & 2 \end{pmatrix}$$

$$k = 1$$

$$i = 2$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \boxed{\begin{pmatrix} \boxed{1} & 1 & 1 \\ \textcolor{blue}{1} & \textbf{1.0001} & \textbf{2} \\ 1 & 2 & 2 \end{pmatrix}}$$

$$R_2 \leftarrow R_2 - \frac{\textcolor{blue}{1}}{\textcolor{red}{1}} R_1$$

$$\begin{array}{r} \begin{pmatrix} \textbf{1} & \textbf{1.0001} & \textbf{2} \end{pmatrix} \\ - \frac{\textcolor{blue}{1}}{\textcolor{red}{1}} \begin{pmatrix} 1 & 1 & 1 \end{pmatrix} \\ \hline \begin{pmatrix} \textbf{0} & \textbf{0.0001} & \textbf{1} \end{pmatrix} \end{array}$$

$$\boxed{\begin{pmatrix} 1 & 1 & 1 \\ \textbf{1} & \textbf{1.0001} & \textbf{2} \\ 1 & 2 & 2 \end{pmatrix}} = \begin{pmatrix} 1 & 0 & 0 \\ \textcolor{red}{1} & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 & 1 \\ \textbf{0} & \textbf{0.0001} & \textbf{1} \\ 1 & 2 & 2 \end{pmatrix}$$

$$k = 1$$

$$i = 2$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ \textcolor{red}{1} & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \boxed{1} & 1 & 1 \\ \mathbf{0} & \mathbf{0.0001} & \mathbf{1} \\ 1 & 2 & 2 \end{pmatrix}$$

$$k = 1$$

$$i = 3$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \boxed{\begin{pmatrix} \color{red}{1} & 1 & 1 \\ 0 & 0.0001 & 1 \\ \color{blue}{1} & 2 & 2 \end{pmatrix}}$$

$$R_3 \leftarrow R_3 - \frac{\color{blue}{1}}{\color{red}{1}} R_1$$

$$\begin{array}{r} \begin{pmatrix} \mathbf{1} & \mathbf{2} & \mathbf{2} \end{pmatrix} \\ -\frac{\color{blue}{1}}{\color{red}{1}} \begin{pmatrix} \mathbf{1} & \mathbf{1} & \mathbf{1} \end{pmatrix} \\ \hline \begin{pmatrix} \mathbf{0} & \mathbf{1} & \mathbf{1} \end{pmatrix} \end{array}$$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \color{red}{-1} & 0 & 1 \end{pmatrix} \boxed{\begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ \color{blue}{1} & 2 & 2 \end{pmatrix}} = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ \mathbf{0} & \mathbf{1} & \mathbf{1} \end{pmatrix}$$

$$k = 1$$

$$i = 3$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \boxed{\begin{pmatrix} \color{red}{1} & 1 & 1 \\ 0 & 0.0001 & 1 \\ \color{blue}{1} & 2 & 2 \end{pmatrix}}$$

$$R_3 \leftarrow R_3 - \frac{\color{blue}{1}}{\color{red}{1}} R_1$$

$$\begin{array}{r} \begin{pmatrix} \color{red}{1} & \color{red}{2} & \color{red}{2} \end{pmatrix} \\ -\frac{\color{blue}{1}}{\color{red}{1}} \begin{pmatrix} \color{red}{1} & \color{red}{1} & \color{red}{1} \end{pmatrix} \\ \hline \begin{pmatrix} \color{red}{0} & \color{red}{1} & \color{red}{1} \end{pmatrix} \end{array}$$

$$\boxed{\begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ \color{red}{1} & 2 & 2 \end{pmatrix}} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \color{red}{1} & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ \color{red}{0} & 1 & 1 \end{pmatrix}$$

$$k = 1$$

$$i = 3$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ \textcolor{red}{1} & 0 & 1 \end{pmatrix} \begin{pmatrix} \boxed{1} & 1 & 1 \\ 0 & 0.0001 & 1 \\ \mathbf{0} & \mathbf{1} & \mathbf{1} \end{pmatrix}$$

$$k = 2$$

$$i = 3$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix} \left[\begin{pmatrix} 1 & 1 & 1 \\ 0 & \boxed{0.0001} & 1 \\ \mathbf{0} & \mathbf{1} & \mathbf{1} \end{pmatrix} \right]$$

$$R_3 \leftarrow R_3 - \frac{1}{0.0001} R_2$$

$$\begin{array}{r} \begin{pmatrix} \mathbf{0} & \mathbf{1} & \mathbf{1} \end{pmatrix} \\ - \frac{1}{0.0001} \begin{pmatrix} 0 & 0.0001 & 1 \end{pmatrix} \\ \hline \begin{pmatrix} \mathbf{0} & \mathbf{0} & -\mathbf{9999} \end{pmatrix} \end{array}$$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -10000 & 1 \end{pmatrix} \left[\begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ \mathbf{0} & \mathbf{1} & \mathbf{1} \end{pmatrix} \right] = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ \mathbf{0} & \mathbf{0} & -\mathbf{9999} \end{pmatrix}$$

$$k = 2$$

$$i = 3$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix} \left[\begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ 0 & 1 & 1 \end{pmatrix} \right]$$

$$R_3 \leftarrow R_3 - \frac{1}{0.0001} R_2$$

$$\begin{array}{r} \begin{pmatrix} 0 & 1 & 1 \end{pmatrix} \\ - \frac{1}{0.0001} \begin{pmatrix} 0 & 0.0001 & 1 \end{pmatrix} \\ \hline \begin{pmatrix} 0 & 0 & -9999 \end{pmatrix} \end{array}$$

$$\left[\begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ 0 & 1 & 1 \end{pmatrix} \right] = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 10000 & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ 0 & 0 & -9999 \end{pmatrix}$$

$$k = 2$$

$$i = 3$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & \textcolor{red}{10000} & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 & 1 \\ 0 & \boxed{0.0001} & 1 \\ 0 & \mathbf{0} & -\mathbf{9999} \end{pmatrix}$$

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 10000 & 1 \end{pmatrix} \begin{pmatrix} 1 & 1 & 1 \\ 0 & 0.0001 & 1 \\ 0 & 0 & -9999 \end{pmatrix}$$