$$\operatorname{Det} A = -1^{1} \cdot (10 \cdot 4 \cdot (-0.5)) = 20$$

$$A = \begin{pmatrix} 10 & 0 & 3 \\ 3 & -1 & 0 \\ -2 & 4 & 1 \end{pmatrix},\ b = \begin{pmatrix} 7 \\ 2 \\ 1 \end{pmatrix}$$

$P_1 = E$

$$M_1 = \begin{pmatrix} \frac{1}{10} & 0 & 0 \\ -\frac{3}{10} & 1 & 0 \\ +\frac{2}{10} & & 1 \end{pmatrix}$$

$$\left(\begin{array}{ccc|c} 10 & 0 & 3 & 7 \\ 3 & -1 & 0 & 2 \\ -2 & 4 & 1 & 1 \end{array}\right) \overset{E}{\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}} \sim$$

$$A_1 = M_1 P_1 A = \begin{pmatrix} \frac{1}{10} & 0 & 0 \\ -\frac{3}{10} & 1 & 0 \\ +\frac{2}{10} & 0 & 1 \end{pmatrix} \left(\begin{array}{ccc|c} 10 & 0 & 3 & 7 \\ 3 & -1 & 0 & 2 \\ -2 & 4 & 1 & 1 \end{array}\right) = \left(\begin{array}{ccc|c} 1 & 0 & 0.3 & 0.7 \\ 0 & -1 & -0.9 & -0.1 \\ 0 & 4 & 1.6 & 2.4 \end{array}\right)$$

$$P_2 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix};\quad P_2 A_1 = \left(\begin{array}{ccc|c} 1 & 0 & 0.3 & 0.7 \\ 0 & 4 & 1.6 & 2.4 \\ 0 & -1 & -0.9 & -0.1 \end{array}\right)$$

$$M_2 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{1}{4} & 0 \\ 0 & +\frac{1}{4} & 1 \end{pmatrix};\quad A_3 = M_2 P_2 A_1 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{1}{4} & 0 \\ 0 & +\frac{1}{4} & 1 \end{pmatrix} \left(\begin{array}{ccc|c} 1 & 0 & 0.3 & 0.7 \\ 0 & 4 & 1.6 & 2.4 \\ 0 & -1 & -0.9 & -0.1 \end{array}\right) = \left(\begin{array}{ccc|c} 1 & 0 & 0.3 & 0.7 \\ 0 & 1 & 0.4 & 0.6 \\ 0 & 0 & -0.5 & 0.5 \end{array}\right)$$

$$M_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -2 \end{pmatrix};\quad P_3 = E;\quad A_4 = M_3 P_3 A_3 = \left(\begin{array}{ccc|c} 1 & 0 & 0.3 & 0.7 \\ 0 & 1 & 0.4 & 0.6 \\ 0 & 0 & 1 & -1 \end{array}\right)$$

$x_3 = -1$

$x_2 = 0.6 - (-1) \cdot 0.4 = 1$

$x_1 = 1$

1) $E_1 = M_1 \cdot P_1 E = M_1$

2) $$E_2 = M_2 \cdot P_2 \cdot M_1 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{1}{4} & 0 \\ 0 & +\frac{1}{4} & 1 \end{pmatrix} \begin{pmatrix} \frac{1}{10} & 0 & 0 \\ +\frac{2}{10} & 0 & 1 \\ -\frac{3}{10} & 1 & 0 \end{pmatrix} = \begin{pmatrix} 21 & 0 & 0 \\ \frac{1}{20} & 0 & \frac{1}{4} \\ -\frac{1}{4} & 1 & \frac{1}{4} \end{pmatrix}$$

3) $$E_3 = M_3 \cdot P_3 \cdot E_2 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -2 \end{pmatrix} \begin{pmatrix} 21 & 0 & 0 \\ \frac{1}{20} & 0 & \frac{1}{4} \\ -\frac{1}{4} & 1 & \frac{1}{4} \end{pmatrix} = \begin{pmatrix} 0.1 & 0 & 0 \\ \frac{1}{20} & 0 & \frac{1}{4} \\ \frac{1}{2} & -2 & -\frac{1}{2} \end{pmatrix} = \tilde{E}$$

$$A^{-1} = X = \{x_j\}$$

$$A_4 x_j = \tilde{e}_j,\quad j = \overline{1,3}$$

$$\tilde{E} = \{\tilde{e}_j\}_{j=1}^{3}$$

$$A = LU$$

① $$\left(\begin{array}{ccc|c} 1 & 0 & 0.3 & \frac{1}{10} \\ 0 & 1 & 0.4 & \frac{1}{20} \\ 0 & 0 & 1 & \frac{1}{2} \end{array}\right)$$

$x_3 = \frac{1}{2}$

$x_2 = \frac{1}{20} - \frac{4}{10} \cdot \frac{1}{2} = -\frac{3}{20}$

$x_1 = \frac{1}{10} - \frac{3}{10} \cdot \frac{1}{2} = -\frac{1}{20}$

② $$\left(\begin{array}{ccc|c} 1 & 0 & 0.3 & 0 \\ 0 & 1 & 0.4 & 0 \\ 0 & 0 & 1 & -2 \end{array}\right)$$

$x_3 = -2$

$x_2 = 0.8$

$x_1 = 0.6$

③ $$\left(\begin{array}{ccc|c} 1 & 0 & 0.3 & 0 \\ 0 & 1 & 0.4 & \frac{1}{4} \\ 0 & 0 & 1 & -\frac{1}{2} \end{array}\right)$$

$x_3 = -\frac{1}{2}$

$x_2 = \frac{1}{4} + \frac{4}{10} \cdot \frac{1}{2} = \frac{3}{20}$

$x_1 = \frac{3}{20}$

$$\begin{array}{c} \begin{array}{ccc} ① & ② & ③ \end{array} \\ \begin{pmatrix} -\frac{1}{20} & 0.6 & \frac{3}{20} \\ -\frac{3}{20} & 0.8 & \frac{3}{20} \\ \frac{1}{2} & -2 & -\frac{1}{2} \end{pmatrix} \end{array} = A^{-1}$$

$A \bar{x}_j = \bar{e}_j$

$L \underbrace{U \bar{x}_j}_{\bar{y}_j} = \bar{e}_j$

$L \bar{y}_j = \bar{e}_j$

$U \bar{x}_j = \bar{y}_j$

$U = A_4$

$L = M^{-1}$

miro

Метод квадратного кореня

$$A=\begin{pmatrix}1&-1&1&-1\\-1&5&-3&3\\1&-3&-7&1\\-1&3&1&10\end{pmatrix},\ \bar b=\begin{pmatrix}2\\-4\\-18\\-5\end{pmatrix}.$$

$$A=S^TDS$$

$$j=\overline{i,n}\quad\begin{cases} d_{ii}=\operatorname{sign}\left(a_{ii}-\sum_{k=1}^{i-1}s_{ki}^2\cdot d_{kk}\right)\\ s_{ii}=\sqrt{\left|a_{ii}-\sum_{k=1}^{i-1}s_{ki}^2\cdot d_{kk}\right|}\\ s_{ij}=\dfrac{a_{ij}-\sum_{k=1}^{i-1}s_{ki}\cdot s_{kj}\,d_{kk}}{s_{ii}\cdot d_{ii}}\end{cases}$$

$d_{11}=1 \quad s_{11}=1$

$s_{12}=-1 \quad s_{13}=1 \quad s_{14}=-1$

$d_{22}=\operatorname{sign}(5-1)=1$

$s_{22}=2$

$s_{23}=\dfrac{-3-(-1)\cdot1\cdot1}{2}=-1$

$s_{24}=\dfrac{3-(-1)\cdot(-1)\cdot1}{2}=1$

$d_{33}=\operatorname{sign}(-7-(1\cdot1+1\cdot1))=-1$

$s_{33}=3$

$s_{34}=\dfrac{1-(1\cdot(-1)\cdot1+(-1)\cdot1\cdot1)}{-3}=-1$

$d_{44}=\operatorname{sign}(10-(1\cdot1+1\cdot1+1\cdot(-1)))=1$

$s_{44}=3$

$$D=\begin{pmatrix}1&0&0&0\\0&1&0&0\\0&0&-1&0\\0&0&0&1\end{pmatrix}$$

$$S=\begin{pmatrix}1&-1&1&-1\\0&2&-1&1\\0&0&3&-1\\0&0&0&3\end{pmatrix}$$

$$\det A=\prod_{i=1}^{n}s_{ii}^2d_{ii}=$$
$$=1\cdot4\cdot9\cdot9\cdot(-1)=-324$$

$$S^TD\underbrace{S\bar x}_{\bar y}=\bar b$$

$$S^TD\bar y=\bar b$$

$$S\bar x=\bar y$$

$$S^TD=\begin{pmatrix}1&0&0&0\\-1&2&0&0\\1&-1&3&0\\-1&1&-1&3\end{pmatrix}\cdot\begin{pmatrix}1&0&0&0\\0&1&0&0\\0&0&-1&0\\0&0&0&1\end{pmatrix}=\begin{pmatrix}1&0&0&0\\-1&2&0&0\\1&-1&-3&0\\-1&1&1&3\end{pmatrix}$$

$$\left(\begin{array}{cccc|c}1&0&0&0&2\\-1&2&0&0&-4\\1&-1&-3&0&-18\\-1&1&1&3&-5\end{array}\right)$$

$y_1=2$

$y_2=-1$

$y_3=\dfrac{-18-2-1}{-3}=7$

$y_4=\dfrac{-5+2+1-7}{3}=-3$

Розв.

$$\left(\begin{array}{cccc|c}1&-1&1&-1&2\\0&2&-1&1&-1\\0&0&3&-1&7\\0&0&0&3&-3\end{array}\right)$$

$x_1=2-1-2+1=0$

$x_2=\dfrac{-1+1+2}{2}=1$

$x_3=\dfrac{7-1}{3}=2$

$x_4=-1$

$$S^TD\cdot\underbrace{S\cdot\bar x_j}_{\bar y_j}=\bar e_j$$

$$S^TD\cdot\bar y_j=\bar e_j$$

$$S\bar x_j=\bar y_j$$

$$A^{-1}=\{x_j\}_{j=1}^{n} \qquad n=3$$