

$$\begin{aligned} x_1 + 2x_2 + x_3 &= -1 \\ -3x_1 + x_2 + x_3 &= 0 \\ x_1 + 2x_3 &= 1 \end{aligned} \implies \begin{bmatrix} 1 & 2 & 1 \\ -3 & 1 & 1 \\ 1 & 0 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$$

Using the formula $Row_i := Row_i - \left(\frac{A_{ik}}{A_{kk}}\right) \cdot Row_k$:

$A_{ik} = A_{21}$ hence $i = 2$ and $k = 1$

$$\begin{aligned} Row_2 &:= Row_2 - \left(\frac{A_{21}}{A_{11}}\right) \cdot Row_1 \\ &= [-3 \quad 1 \quad 1] - \left(\frac{-3}{1}\right) \cdot [1 \quad 2 \quad 1] \\ &= [0 \quad 7 \quad 4] \end{aligned}$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 7 & 4 \\ 1 & 0 & 3 \end{bmatrix}$$

$A_{ik} = A_{31}$ hence $i = 3$ and $k = 1$

$$\begin{aligned} Row_3 &:= Row_3 - \left(\frac{A_{31}}{A_{11}}\right) \cdot Row_1 \\ &= [1 \quad 0 \quad 3] - \left(\frac{1}{1}\right) \cdot [1 \quad 2 \quad 1] \\ &= [0 \quad -2 \quad 2] \end{aligned}$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 7 & 4 \\ 0 & -2 & 2 \end{bmatrix}$$

$A_{ik} = A_{32}$ hence $i = 3$ and $k = 2$

$$\begin{aligned} Row_3 &:= Row_3 - \left(\frac{A_{32}}{A_{22}}\right) \cdot Row_2 \\ &= [0 \quad -2 \quad 2] - \left(\frac{-2}{7}\right) \cdot [0 \quad 7 \quad 4] \\ &= [0 \quad 0 \quad \frac{22}{7}] \end{aligned}$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 7 & 4 \\ 0 & 0 & \frac{22}{7} \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 \\ -3 & 1 & 1 \\ 1 & 0 & 3 \end{bmatrix}^A = \begin{bmatrix} 1 & 0 & 0 \\ -3 & 1 & 0 \\ 1 & -\frac{2}{7} & 1 \end{bmatrix}^L \begin{bmatrix} 1 & 2 & 1 \\ 0 & 7 & 4 \\ 0 & 0 & \frac{22}{7} \end{bmatrix}^U$$

$$Lw = b \implies \begin{bmatrix} 1 & 0 & 0 \\ -3 & 1 & 0 \\ 1 & -\frac{2}{7} & 1 \end{bmatrix}^L \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix}^w = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}^b$$

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for j = 1 to n:
  j = 1
  w1 = b1 / L11 = -1 / 1 = -1
  for i = j + 1 to n:
    i = 2
    b2 = b2 - L21 * w1 = 0 - (-3) * (-1) = -3
    i = 3
    b3 = b3 - L31 * w1 = 1 - 1 * (-1) = 2
  j = 2
  w2 = b2 / L22 = -3 / 1 = -3
  for i = j + 1 to n:
    i = 3
    b3 = b3 - L32 * w2 = 2 - (-2 / 7) * (-3) = 8 / 7
  j = 3
  w3 = b3 / L33 = (8 / 7) / 1 = 8 / 7
  for i = j + 1 to n:
    i = 4 -> skip

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$$Ux = w \implies \begin{bmatrix} 1 & 2 & 1 \\ 0 & 7 & 4 \\ 0 & 0 & \frac{22}{7} \end{bmatrix}^U \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}^x = \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix}^w = \begin{bmatrix} -1 \\ -3 \\ \frac{8}{7} \end{bmatrix}^w$$

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