

# ASSIGNMENT III

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16/ENG07/003

Petroleum Engineering

Solution

The augmented matrix is

$$\tilde{A}^{(0)} = \left[ \begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 2 & -1 & 1 & 2 & 1 & -3 & 20 \\ 1 & 3 & -3 & -1 & 2 & 1 & -15 \\ 5 & 2 & -1 & -1 & 2 & 1 & -3 \\ -3 & -1 & 2 & 3 & 1 & 3 & 16 \\ 4 & 3 & 1 & -6 & -3 & -2 & -27 \end{array} \right]$$

$$\tilde{A}^{(2)} = \left[ \begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ E_2 - E_1 & 0 & -1.5 & 2.5 & 0 & -2.5 & -0.5 & 6 \\ \frac{E_3}{2} - E_1 & 0 & 2 & -1 & -2 & -1 & 2 & -19 \\ \frac{E_4}{5} - E_1 & 0 & -0.6 & 1.8 & -1.2 & -2.6 & 1.2 & -4.6 \\ \frac{E_5}{-3} - E_1 & 0 & -0.667 & 1.333 & -2 & -3.333 & 0 & -9.333 \\ \frac{E_6}{4} - E_1 & 0 & -0.25 & 2.25 & -2.5 & -3.75 & 6.5 & -10.75 \end{array} \right]$$

Divide through  $E_3$  by 2 and Swap (Pivot) with  $E_2$

$$\tilde{A}^{(2)} = \left[ \begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & -1.5 & 2.5 & 0 & -2.5 & -0.5 & 6 \\ 0 & -0.6 & 1.8 & -1.2 & -2.6 & 1.2 & -4.6 \\ 0 & -0.667 & 1.333 & -2 & -3.333 & 0 & -9.333 \\ 0 & -0.25 & 2.25 & -2.5 & -3.75 & 0.5 & -10.75 \end{array} \right]$$

$$\tilde{A}^{(3)} = \left[ \begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ \frac{E_3}{1.5} + E_2 & 0 & 0 & 1.167 & -1 & -2.167 & 0.667 & -5.5 \\ \frac{E_4}{0.6} + E_2 & 0 & 0 & 2.5 & -3 & -4.833 & 3 & -17.167 \\ \frac{E_5}{0.667} + E_2 & 0 & 0 & 1.499 & -3.999 & -5.497 & 1 & -23.493 \\ \frac{E_6}{0.25} + E_2 & 0 & 0 & 8.5 & -11 & -18.5 & 3 & -52.5 \end{array} \right]$$



Divide Through  $E_4$  by 2.5 and Swap with  $E_3$

$$A^{(3)} = \begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & 0 & 1 & -1.2 & -1.933 & 1.2 & -6.867 \\ 0 & 0 & 1.167 & -1 & -2.167 & 0.667 & -5.5 \\ 0 & 0 & 1.499 & -3.99 & -5.497 & 1 & -23.493 \\ 0 & 0 & 8.5 & -11 & -15.5 & 3 & -52.5 \end{bmatrix}$$

$$A^{(4)} = \begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & 0 & 1 & -1.2 & -1.933 & 1.2 & -6.867 \\ 0 & 0 & 0 & 0.343 & 0.076 & -0.628 & 2.152 \\ 0 & 0 & 0 & -1.468 & -1.784 & -0.5333 & -8.805 \\ 0 & 0 & 0 & -0.094 & 0.109 & -0.547 & 0.691 \end{bmatrix}$$

$\frac{E_4}{1.167} - E_3 \Rightarrow$

$\frac{E_5}{1.499} - E_3 \Rightarrow$

$\frac{E_6}{8.5} - E_3$

Divide Through  $E_4$  by 0.343

$$A^{(4)} = \begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & 0 & 1 & -1.2 & -1.933 & 1.2 & -6.867 \\ 0 & 0 & 0 & 1 & 0.222 & -1.831 & 6.280 \\ 0 & 0 & 0 & -1.466 & -1.734 & -0.533 & -8.805 \\ 0 & 0 & 0 & -0.094 & 0.109 & -0.847 & 0.691 \end{bmatrix}$$

$$A^{(5)} = \begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & 0 & 1 & -1.2 & -1.933 & 1.2 & -6.867 \\ 0 & 0 & 0 & 1 & 0.222 & -1.831 & 6.280 \\ 0 & 0 & 0 & 0 & 0.959 & 2.194 & -0.282 \\ 0 & 0 & 0 & 0 & -1.382 & 10.842 & -13.631 \end{bmatrix}$$

$\frac{E_5}{-1.468} - E_4$

$\frac{E_6}{-0.094} - E_4$

Divide Through  $E_5$  by 0.959

$$A^{(5)} = \begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & 0 & 1 & -1.2 & -1.933 & 1.2 & -6.867 \\ 0 & 0 & 0 & 1 & 0.222 & -1.831 & 6.280 \\ 0 & 0 & 0 & 0 & 1 & 2.288 & -0.284 \\ 0 & 0 & 0 & 0 & -1.382 & 10.842 & -13.631 \end{bmatrix}$$



$$A^{-1} = \begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & 1 & -0.5 & -1 & -0.5 & 1 & -9.5 \\ 0 & 0 & 1 & -1.2 & -1.933 & 1.2 & -6.867 \\ 0 & 0 & 0 & 1 & 0.222 & -1.831 & 6.280 \\ 0 & 0 & 0 & 0 & 1 & 2.288 & -0.294 \\ 0 & 0 & 0 & 0 & 0 & -10.133 & 10.157 \end{bmatrix}$$

$E_6 - E_5$   
-13.62

from  $E_6: -10.133 T_6 = 10.157$

$$T_6 = -1.002 \approx -1$$

from  $E_5: T_5 + 2.288 T_6 = -0.294$

$$T_5 = -0.294 - 2.288(-1.002)$$

$$T_5 = 1.999 \approx 2$$

from  $E_4: T_4 + 0.222 T_5 - 1.831 T_6 = 6.280$

$$T_4 = -0.222(1.999) + 1.831(-1.002) + 6.280$$

$$T_4 = 4.0002 \approx 4$$

from  $E_3: T_3 - 1.2 T_4 - 1.933 T_5 + 1.2 T_6 = -6.867$

$$T_3 = 1.2(4.002) + 1.933(1.999) - 1.2(-1.002) - 6.867$$

$$T_3 = 3.000 \approx 3$$

from  $E_2: T_2 = 0.5 T_3 - T_4 - 0.5 T_5 + T_6 = -9.5$

$$T_2 = 0.5(3.002) + 4.002 + 0.5(1.999) - (-1.002) - 9.5$$

$$T_2 = -1.996 \approx -2$$

from  $E_1: T_1 + T_2 - 2 T_3 + T_4 + 3 T_5 - T_6 = 4$

$$T_1 = 4 - (-1.996) - 2(3.002) - 4.002 - 3(1.999) + (-1.002)$$

$$T_1 = 0.999 \approx 1$$

$$\therefore T_1 = 1, T_2 = -2, T_3 = 3, T_4 = 4, T_5 = 2 \text{ \& } T_6 = -1$$