Name: BUNU RAJINDER PRETOR

Assignment NO: 3

Mat No: 15/ENG04/013

Dept: ; Elect/Elect

Date : 02/03/2018

Sign:

①

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

$2T_1 - T_2 + T_3 + 2T_4 + T_5 - 3T_6 = 20$

$T_1 + 3T_2 - 3T_3 - T_4 + 2T_5 + T_6 = -15$

$5T_1 + 2T_2 - T_3 - T_4 + 2T_5 + T_6 = -3$

$-3T_1 - T_2 + 2T_3 + 3T_4 + T_5 + 3T_6 = 16$

$4T_1 + 3T_2 + T_3 - 6T_4 - 3T_5 - 2T_6 = -27$

Soln.

Equations in Matrix format;

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 2 & -1 & 1 & 2 & 1 & -3 \\ 1 & 3 & -3 & -1 & 2 & 1 \\ 5 & 2 & -1 & -1 & 2 & 1 \\ -3 & -1 & 2 & 3 & 1 & 3 \\ 4 & 3 & 1 & -6 & -3 & -2 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 20 \\ -15 \\ -3 \\ 16 \\ -27 \end{bmatrix}$$

Augmented form of Matrix above

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 2 & -1 & 1 & 2 & 1 & -3 & 20 \\ 1 & 3 & -3 & -1 & 2 & 1 & -15 \\ 5 & 2 & -1 & -1 & 2 & 1 & -3 \\ -3 & -1 & 2 & 3 & 1 & 3 & 16 \\ 4 & 3 & 1 & -6 & -3 & -2 & -27 \end{array}\right]$$

STEP 1 $[ROW2 - \frac{2}{1} ROW1]$

$2 - \frac{2}{1} \times 1 = 0$

$-1 - 2 \times 1 = -3$

$1 - 2 \times -2 = 5$

$2 - 2 \times 1 = 0$

$1 - 2 \times 3 = -5$

$-3 - 2 \times -1 = -1$

$20 - 2 \times 4 = 12$

Modifying ROW2

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 1 & 3 & -3 & -1 & 2 & 1 & -15 \\ 5 & 2 & -1 & -1 & 2 & 1 & -3 \\ -3 & -1 & 2 & 3 & 1 & 3 & 16 \\ 4 & 3 & 1 & -6 & -3 & -2 & -27 \end{array}\right]$$

STEP 2 $[ROW3 - \frac{1}{1} ROW1]$

$1 - 1 \times 1 = 0$

$3 - 1 \times 1 = 2$

$-3 - 1 \times -2 = -1$

$-1 - 1 \times 1 = -2$

$2 - 1 \times 3 = -1$

$1 - 1 \times -1 = 2$

$-15 - 1 \times 4 = -19$

Modifying Row 3

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 2 & -1 & -2 & -1 & 2 & -19 \\ 5 & 2 & -1 & -1 & 2 & 1 & -3 \\ -3 & -1 & 2 & 3 & 1 & 3 & 16 \\ 4 & 3 & 1 & -6 & -3 & -2 & -27 \end{array}\right]$$

STEP 3 $[ROW4 - \frac{5}{1} ROW1]$

$5 - 5 \times 1 = 0$

$2 - 5 \times 1 = -3$

$-1 - 5 \times -2 = 9$

$-1 - 5 \times 1 = -6$

$2 - 5 \times 3 = -13$

$1 - 5 \times -1 = 6$

$-3 - 5 \times 4 = -23$

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Modifying ROW4

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 2 & -1 & -2 & -1 & 2 & -19 \\ 0 & -3 & 9 & -6 & -13 & 6 & -23 \\ -3 & -1 & 2 & 3 & 1 & 3 & 16 \\ 4 & 3 & 1 & -6 & -3 & -2 & -27 \end{array}\right]$$

STEP 4 [ROW5 − (−3/1) ROW1]

$-3 + 3 \times 1 = 0$

$-1 + 3 \times 1 = 2$

$2 + 3 \times -2 = -4$

$3 + 3(1) = 6$

$1 + 3 \times 3 = 10$

$3 + 3(-1) = 0$

$16 + 3(4) = 28$

Modifying ROW 5

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 2 & -1 & -2 & -1 & 2 & -19 \\ 0 & -3 & 9 & -6 & -13 & 6 & -23 \\ 0 & 2 & -4 & 6 & 10 & 0 & 28 \\ 4 & 3 & 1 & -6 & -3 & -2 & -27 \end{array}\right]$$

STEP 5 [ROW6 − $\frac{4}{1}$ ROW1)

$4 - 4(1) = 0$

$3 - 4(1) = -1$

$1 - 4(-2) = 9$

$-6 - 4(1) = -10$

$-3 - 4(3) = -15$

$-2 - 4(-1) = 2$

$-27 - 4(4) = -43$

Modifying ROW 6

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 2 & -1 & -2 & -1 & 2 & -19 \\ 0 & -3 & 9 & -6 & -13 & 6 & -23 \\ 0 & 2 & -4 & 6 & 10 & 0 & 28 \\ 0 & -1 & 9 & -10 & -15 & 2 & -43 \end{array}\right]$$

STEP 6 [ROW3 + $\frac{2}{3}$ ROW2]

$2 + \frac{2}{3}(-3) = 0$

$-1 + 2/3(5) = 7/3$

$-2 + 2/3(0) = -2$

$-1 + 2/3(-5) = -13/3$

$2 + 2/3(-1) = 4/3$

$-19 + 2/3(12) = -11$

Modifying ROW 3 Again.

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & -3 & 9 & -6 & -13 & 6 & 23 \\ 0 & 2 & -4 & 6 & 10 & 0 & 28 \\ 0 & -1 & 9 & 10 & -15 & 2 & -43 \end{array}\right]$$

STEP 7 [ROW4 − (−2/3) ROW 4]

$-3 + 3/2(2) = 0$

$9 + 3/2(-1) = 15/2$

$-6 + 3/2(-2) = -9$

$-13 + 6/2(-1) = -29/2$

$6 + 3/2(2) = 9$

$-23 + 3/2(-19) = -103/2$

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Modifying ROW4 Again

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 15/2 & -9 & -29/2 & 9 & -103/2 \\ 0 & 2 & -4 & 6 & 10 & 0 & 28 \\ 0 & -1 & 9 & 10 & -15 & 2 & -43 \end{array}\right]$$

STEP 8 [ROW5 − (−2/3) ROW4]

$2 + \frac{2}{3}(-3) = 0$

$-4 + 2/3\,(9) = 2$

$6 + 2/3\,(-6) = 2$

$10 + 2/3\,(-13) = 4/3$

$0 + 2/3\,(6) = 4$

$28 + 2/3\,(-23) = 88/3$

STEP 9 [ROW6 − (−1/2) ROW5]

$-1 + 1/2(2) = 0$

$9 + 1/2(-4) = 7$

$-10 + 1/2\,(6) = -7$

$-15 + 1/2\,(10) = -10$

$2 + 1/2\,(0) = 2$

$-43 + 1/2\,(28) = -29$

Modifying the matrix again;

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 15/2 & -9 & -29/2 & 9 & -103/2 \\ 0 & 0 & 2 & 2 & 4/3 & 4 & 88/3 \\ 0 & 0 & 7 & -7 & -10 & 2 & -29 \end{array}\right]$$

STEP 10 [ROW4 − 45/14 ROW3]

$15/2 - 45/14\,(1/3) = 0$

$-9 - 45/14\,(-2) = -18/7$

$-29/2 - 45/14\,(-13/3) = -4/7$

$9 - 45/14\,(4/3) = 33/7$

$-103/2 - \frac{45}{14}(-11) = -113/7$

STEP 11 [ROW5 − 4/15 ROW4]

$2 - 4/15\,(15/2) = 0$

$2 - 4/15\,(-9) = 22/5$

$4/3 - 4/15\,(-29/2) = 26/5$

$4 - 4/15(9) = 8/5$

$88/3 - 4/15(-103/2) = 132/5$

STEP 12 [ROW6 − 7/2 ROW5]

$7 - 7/2\,(2) = 0$

$-7 - 7/2\,(2) = -14$

$-10 - 7/2\,(4/3) = -44/3$

$2 - 7/2(4) = -12$

$-29 - 7/2\,(88/3) = -220/3$

Modifying the matrix Again.

$$\left[\begin{array}{cccccc|c} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/5 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 & -113/7 \\ 0 & 0 & 0 & 22/5 & 26/5 & 8/5 & 132/5 \\ 0 & 0 & 0 & -14 & -44/3 & -12 & -220/3 \end{array}\right]$$

STEP 13 [ROW5 + 77/45 ROW4]

$22/5 + 77/45\,(-18/7) = 0$

$26/5 + 77/45\,(-4/7) = 38/9$

$8/5 + 77/45\,(33/7) = 29/3$

$132/5 + 77/45\,(-113/7) = -11/9$

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~~Multiplying~~ ~~Row~~

STEP 14 [ROW6 + $\frac{14}{22/5}$ ROW5

$\frac{22}{5} = 4.4$

$-14 + \frac{14}{4.4} \times 4.4 = 0$

$-44/3 + \frac{14}{4.4}(26/5) = 62/33$

$-12 + \frac{14}{4.4}(8/5) = -76/11$

$\frac{-220}{3} + \frac{14}{4.4}(132/5) = 32/3$

Modifying the Matrix again.

$$\left[\begin{array}{ccccccc} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 & -113/7 \\ 0 & 0 & 0 & 0 & 38/9 & 29/3 & -11/9 \\ 0 & 0 & 0 & 0 & 62/33 & -76/11 & 32/3 \end{array}\right]$$

STEP 15 [ROW6 − $\frac{93}{209}$ ROW5]

$62/3 - \frac{93}{209}(38/9) = 0$

$-76/11 - \frac{93}{209}(29/3) = -213/19$

$32/3 + \frac{93}{209}(11/9) = 213/19$

Modifying Matrix again

$$\left[\begin{array}{ccccccc} 1 & 1 & -2 & 1 & 3 & -1 & 4 \\ 0 & -3 & 5 & 0 & -5 & -1 & 12 \\ 0 & 0 & 7/3 & -2 & -13/3 & 4/3 & -11 \\ 0 & 0 & 0 & -18/7 & -4/7 & 33/7 & -113/7 \\ 0 & 0 & 0 & 0 & 38/9 & 29/3 & -11/9 \\ 0 & 0 & 0 & 0 & 0 & -213/19 & 213/19 \end{array}\right]$$

from the ~~Mate~~ matrix above we can obtain the values of $T_1, T_2, T_3, T_4, T_5, \& T_6$

$\frac{-213}{19} T_6 = \frac{213}{19}$

$T_6 = -1$

To get T_5

$\frac{38}{9} T_5 + \frac{29}{3} T_6 = \frac{-11}{9}$

$\frac{38}{9} T_5 - \frac{29}{3} = \frac{-11}{9}$

$\frac{38}{9} T_5 = \frac{-11}{9} + \frac{29}{3}$

$\frac{38}{9} T_5 = \frac{76}{9}$

$T_5 = \frac{76}{9} \times \frac{9}{38}$

$T_5 = 2$

To get T_4 (Values of T_6 and T_5 substituted directly.

$\frac{-18}{7} T_4 - \frac{4}{7}(2) + \frac{33}{7}(-1) = \frac{-113}{7}$

$\frac{-18}{7} T_4 - \frac{8}{7} - \frac{33}{7} = \frac{-113}{7}$

$\frac{-18}{7} T_4 - \frac{41}{7} = \frac{-113}{7}$

multiply through by 7

$-18T_4 - 41 = -113$

$-18T_4 = -113 + 41$

$T_4 = \frac{+72}{+18}$

$T_4 = 4$

To get T_3

$\frac{7}{3} T_3 - 2(4) - \frac{13}{3}(2) + \frac{4}{3}(-1) = -11$

$\frac{7}{3} T_3 - 8 - \frac{26}{3} - 4/3 = -11$

$7/3\, T_3 - 18 = -11$

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Name: BUNU RAJINDER PREYOR SIGN:

Mat-No: 15/ENG04/013

Continuation of Question 1

$\frac{7}{3}T_3 = -11 + \frac{47}{3}$

$7/3\, T_3 = \frac{14}{3}$

$T_3 = \frac{14}{3} \times \frac{3}{7}$

$\frac{7}{3}T_3 = -11 + 18$

$T_3 = 7 \times \frac{3}{7}$

$T_3 = 3$

To get T_2;

$-3T_2 + 5(3) - 5(2) - 1(-1) = 12$

$-3T_2 + 6 = 12$

$-3T_2 = 6$

$T_2 = -2$

To get T_1

$T_1 + (-2) - 2(3) + 1(4) + 3(2) + 1 = 4$

$T_1 = 4 - 3$

$T_1 = 1$

This implies that

$T_1 = 1$,

$T_2 = -2$,

$T_3 = 3$,

$T_4 = 4$,

$T_5 = 2$, and

$T_6 = -1$.

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