Lab 6: Solution of Simultaneous Equations

Gauss Elimination Method.

1. Forward Elimination

$$A_b = \begin{bmatrix} a_{11} & a_{12} & a_{13} & b_1 \\ a_{21} & a_{22} & a_{23} & b_2 \\ a_{31} & a_{32} & a_{33} & b_3 \end{bmatrix}$$

$$= \begin{bmatrix} a_{11} & a_{12} & a_{13} & b_1 \\ 0 & a'_{22} & a'_{23} & b'_2 \\ 0 & 0 & a''_{33} & b''_3 \end{bmatrix}$$

2. Back Substitution

$$x_3 = {b''_3}\Big/{a''_{33}}$$

$$x_2 = {(b'_2 - a'_{23}x_3)}\Big/{a'_{22}}$$

$$x_1 = {(b_1 - a_{12}x_2 - a_{13}x_3)}/{a_{11}}$$

Gauss Jordan Method.

$$A_b = \begin{bmatrix} a_{11} & a_{12} & a_{13} & b_1 \\ a_{21} & a_{22} & a_{23} & b_2 \\ a_{31} & a_{32} & a_{33} & b_3 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & b_1^{(n)} \\ 0 & 1 & 0 & b_2^{(n)} \\ 0 & 0 & 1 & b_3^{(n)} \end{bmatrix}$$

$$x_1 = b_1^{(n)}$$

$$x_2 = b_2^{(n)}$$

$$x_3 = b_3^{(n)}$$

Elementary row operations

1. We may multiply any row of the augmented coefficient matrix by a constant.
2. We can add a multiple of one row to any other row.
3. We can interchange the order of any two rows.

Note:

- Interchange the rows if there is zero in diagonal.
- Make the system diagonally dominant.

LAB TASKS

1. **Implement the following system of Linear equations by using Gauss Elimination method in R.**

$$-8x_1 + x_2 - 2x_3 = -20$$

$$2x_1 - 6x_2 - 1x_3 = -38$$

$$-3x_1 - x_2 + 7x_3 = -34$$

2. **Implement the system of linear equations given in Question 1 by using Gauss Jordan method in R.**