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**Numerical Methods - MA 207**
**Numerical Solution of Linear Equations & Power Method**

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1. Is the system of equations diagonally dominant? If not, make it diagonally dominant.

$$\begin{aligned} 3x + 9y - 2z &= 10 \\ 4x + 2y + 13z &= 19 \\ 4x - 2y + z &= 3. \end{aligned}$$

2. Check whether the system of equations

$$\begin{aligned} x + 6y - 2z &= 5 \\ 4x + y + z &= 6 \\ -3x + y + 7z &= 5. \end{aligned}$$

   is a diagonal system. If not, make it a diagonal system.

3. Solve, by Jacobi's iterative method, the equations

$$\begin{aligned} 20x + y - 2z &= 17 \\ 3x + 20y - z &= -18 \\ 2x - 3y + 20z &= 25. \end{aligned}$$

4. Solve, by Jacobi's iterative method correct to 2 decimal places, the equations

$$\begin{aligned} 10x + y - z &= 11.19 \\ x + 10y + z &= 28.08 \\ -x + y + 10z &= 35.61. \end{aligned}$$

5. Solve the equations, by Gauss-Jacobi iterative method

$$\begin{aligned} 10x_1 - 2x_2 - x_3 - x_4 &= 3 \\ -2x_1 + 10x_2 - x_3 - x_4 &= 15 \\ -x_1 - x_2 + 10x_3 - 2x_4 &= 27 \\ -x_1 - x_2 - 2x_3 + 10x_4 &= -9. \end{aligned}$$

6. Apply Gauss-Seidel iterative method to solve the equations

$$\begin{aligned} 20x + y - 2z &= 17 \\ 3x + 20y - z &= -18 \\ 2x - 3y + 20z &= 25. \end{aligned}$$

7. Solve the equations, by Gauss-Jacobi and Gauss-Seidel methods (and compare the values)

$$\begin{aligned} 27x + 6y - z &= 85 \\ x + y + 54z &= 110 \\ 6x + 15y + 2z &= 72. \end{aligned}$$

8. Apply Gauss-Seidel iterative method to solve the equations

$$\begin{aligned} 10x_1 - 2x_2 - x_3 - x_4 &= 3 \\ -2x_1 + 10x_2 - x_3 - x_4 &= 15 \\ -x_1 - x_2 + 10x_3 - 2x_4 &= 27 \\ -x_1 - x_2 - 2x_3 + 10x_4 &= -9. \end{aligned}$$

9. Solve by relaxation method, the equations

$$\begin{aligned} 9x - 2y + z &= 50 \\ x + 5y - 3z &= 18 \\ -2x + 2y + 7z &= 19. \end{aligned}$$

10. Solve by relaxation method, the equations

$$\begin{aligned} 10x - 2y - 3z &= 205 \\ -2x + 10y - 2z &= 154 \\ -2x - y + 10z &= 120. \end{aligned}$$

11. Say true or false with justification: If $\lambda$ is the dominant eigen value of $A$ and $\beta$ is the dominant eigen value of $A - \lambda I$, then the smallest eigen value of $A$ is $\lambda + \beta$.

12. Determine the largest eigen value and the corresponding eigen vector of the matrix

$$\begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}.$$

13. Find the largest eigen value and the corresponding eigen vector of the matrix

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

using power method. Take $[1,\ 0,\ 0]^T$ as an initial eigen vector.

14. Obtain by power method, the numerically dominant eigen value and eigen vector of the matrix

$$\begin{pmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2. \end{pmatrix}$$

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