Exercises

(1) Use Jacobi's method to solve the following system of equations, with $x^{(0)} = (1,1,1)^T$ as initial approximation, correct to 2 significant figures.

$$x - 10y + 3z = 39$$
$$10x - 2y - 5z = 26$$
$$4x - 5y + 10z = 47$$

What is the minimum number of iterations required to get 5 significant digit accuracy, if 5 digit arithmetic is used.

(Ans: True solution $(3, -3, 2)^T$; number of iteration required=36)

(2) Do three iterations of Jacobi's method to solve

$$-2x + 3y + 10z = 22$$
$$10x + 2y + z = 9$$
$$x + 10y - z = -22$$

with $x^{(0)} = (1, -1, 1)^T$ as starting vector. What is the minimum number of iterations required, so that the solution is correct to 4 decimal places.

(Ans: True solution $(1, -2, 3)^T$; number of iteration required =17)

(3) Solve, by Gauss-Seidal iteration method, the system of linear equations

$$3x + 9y - 2z = 11$$
$$4x + 2y + 13z = 24$$
$$4x - 2y + z = -8$$

correct up to four significant figures.

(Ans: $x = -1.423, y = 2.131, z = 1.956$)

(4) Compute the solution of the system of linear equations by Gauss-Seidal iteration method

$$6.7x + 1.1y + 2.2z = 20.5$$
$$3.1x + 9.4y - 1.5z = 22.9$$
$$2.1x - 1.5y + 8.4z = 28.8$$

correct up to 3-significant figures.

(Ans: $x = 1.50, y = 2.50, z = 3.50$)

(5) Do five iterations of each Jacobi's and Gauss Seidel method to solve

$$2x + 3y + 7z = 16$$
$$3x + y + z = 6$$
$$x + 5y + 3z = 10$$

with starting initial guess as (x, y, z) = (1,1,1). What is the minimum number of iterations required, so that the solutions correct to 8 significant figures?

(Ans: True solution: $x = 1.2, y = 0.8, z = 1.6$)