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2020SC04497

Mathematical Foundations for Data Science
Assignment - I

Q1. Write a code to perform Gauss elimination method with and without pivoting for a 2x2 System, taking the number of significant digits (d) to be considered as user input. Using the code, solve the 2x2 System with random Coefficients for d = 3, 4, 5, 6. Display results in tabular form.

Significant digits (d)	Gauss elimination without Pivoting	Gauss elimination with Pivoting
3	Equation:- $0.804x + 0.898y = 0.598$ $0.0446x + 0.639y = 0.13$ $x = 0.56$; $y = 0.164$	$x = 0.56$; $y = 0.164$
4	Equation:- $0.3497x + 0.6754y = 0.5517$ $0.7338x + 0.569y = 0.01432$ $x = -1.026$; $y = 1.348$	$x = -1.026$ $y = 1.348$
5	Equation:- $0.82325x + 0.67003y = 0.78329$ $0.16992x + 0.72131y = 0.33422$ $x = 0.71059$; $y = 0.29596$	$x = 0.71059$; $y = 0.29596$
6	Equation:- $0.867742x + 0.0836748y = 0.230635$ $0.202514x + 0.462127y = 0.396468$ $x = 0.191211$; $y = 0.774127$	$x = 0.191211$; $y = 0.774127$

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Q2. Write a code to perform
a) Gauss Jacobi method
b) Gauss Seidel method
for a 3x3 system by checking the convergence criteria using a suitable norm. Test the method on a random 3x3 System, which is diagonally dominant and check your result. A comparison b/w the two methods should be presented in tabular form. The stopping criteria could be taken as the lowest iteration number when the iteration number when the relative percentage error is less than 1%.

Gauss Jacobi	Gauss Seidel

Gauss Jacobi

Equation:-

$$2.1606x + 0.2518y + 0.291z = 0.6178$$
$$0.8586x + 2.24128y + 0.02258z = 0.3601$$
$$0.9647x + 0.01258y + 2.21978z = 0.2425$$

Count	x	y	z
1	0.2859	0.1607	0.1092
2	0.2525	0.0500	-0.0159
3.	0.2823	0.0641	-0.0008
4	0.2786	0.0525	-0.0138
5	0.2817	0.0541	-0.0121
6	0.2813	0.0529	-0.0135

Gauss Seidel

Count	x	y	z
1	0.2859	0.0511	-0.0153
2	0.2820	0.0528	-0.0136
3	0.2816	0.0529	-0.0134

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Generate a random matrix of 3x3 which cannot be made diagonally dominant and check if the iterates ~~Coverag~~ converge. The random entries generated should be of the form n.dddd.

$$\text{matrix } A = \left[\begin{array}{ccc|c} 0.5032 & 0.3849 & 0.6939 & 0.811 \\ 0.7961 & 0.5438 & 0.1128 & 0.2919 \\ 0.6073 & 0.427 & 0.2091 & 0.7019 \end{array}\right]$$

The equations are divergent. Does not converge. The number of iterations go upto 1300 and the values for x, y and z reaches inf as the program limits only when the tolerance is achieved.