ME 542

Assignment – 3

Gauss Elimination and Partial Pivoting

- Students need to save all the programs in a zipped file. Name it with your roll number and submit it on MS TEAMS.
- The programs are to be compiled and checked before submitting.
- Results obtained by your code should be written (do not copy the image file of your run) in a pdf file, and keep this file also in the same zipped folder.

Solve the following systems of linear equations using Gauss elimination with partial pivoting.

(a)

$$2x_1 + x_2 + x_3 = 4$$
$$4x_1 + 3x_2 + 3x_3 + x_4 = 6$$
$$8x_1 + 7x_2 + 9x_3 + 5x_4 = 8$$
$$6x_1 + 7x_2 + 9x_3 + 8x_4 = -2$$

(b) $5x_1 + 6x_2 + 9x_3 = 29, 6x_1 + 9x_2 + 2x_3 = 19, 11x_1 + 9x_2 + 5x_3 = 30$

(c) $5x_1 + 6x_2 + 9x_3 = 29, 6x_1 + 9x_2 + 2x_3 = 19, 11x_1 + 159x_2 + 11.001x_3 = 49.002$

(d) Hilbert matrix, matrix $H = [h_{ij} = \frac{1}{i+j-1}]$ where i is the $i-$th row and j is the $j-$column. The vector $b = [b_i = \sum_{j=1}^{n} h_{ij}]$. Keep the size of the matrix as input to the code and check for a 5×5 Hilbert matrix.

- Use different number of significant digits and compare $||x - x^*||_2$ and $||x - x^*||_\infty$, where x is the solution obtained from your code and x^* is the solution with 10 significant digits. Apply the concept of significant digits in backpropagation when the value of the components of vector x is estimated.
- Calculate the exact number of function evaluations for different significant digits and compare. Number of function evaluations includes multiplication and division in every operation.
- Include the results in a tabular form and submit a pdf file along with the source code.