

ESO208A: Computer Assignment-2

Marks: 100

Due Date: Monday, September 27, 2021

Write a computer program for solving a system of linear equations $Ax = b$. The program should have the following features:

Input: The program should read the following inputs from a text file – (i) the number of equations (n), (ii) elements of the augmented matrix. [Please see an example of input data file below].

Options: The user should have the option of selecting one of the following methods–

- a. Gauss elimination (GE; without pivoting)
- b. GE (with pivoting)
- c. GE (with scaling and pivoting)
- d. LU decomposition by using GE (without pivoting)
- e. LU decomposition by using GE (with pivoting)
- f. LU decomposition by using Crout method (without pivoting)
- g. Cholesky decomposition (for symmetric positive definite matrix)

Output: The output from the program should be written in a text file. This file should contain the following results for different methods–

- a. GE: the unknowns x , the permutation matrix (if pivoting is done), and the elements of U
- b. LU by GE: the unknowns x , the permutation matrix (if pivoting is done), and the elements of L and U
- c. LU by Crout method: the unknowns x and the elements of L and U
- d. Cholesky decomposition: the unknowns x and the elements of Cholesky factor, L_C .

Submission

Make a single zip folder with all your program file(s) name it roll number_CA1.zip (e.g., If your roll number is 123456, the folder name should be '123456_CA1.zip'). The folder should include -

(i) All the computer program file(s), input file(s) and output file(s)

(ii) A PDF file of the plots and the solution of the test cases given in this assignment.

Upload the zip file on mooKIT. In case of any difficulties with mooKIT upload, you may email the solution to eso208.sec*@gmail.com, where * is section number 1-10. Example: for section J5, it is eso208.sec5@gmail.com; for section J10, it is eso208.sec10@gmail.com. The subject line of the email should be same as your folder name.

Suggestion: *Test all the features of your program for at least 2 to 3 different datasets of different sizes before submission.*

Test data:

$$4x_1 + 2x_2 = 10$$
$$2x_1 + 4x_2 + x_3 = 11.5$$
$$x_2 + 5x_3 = 5$$

Sample input file

```
3
4.0    2.0    0.0    10.0
2.0    4.0    1.0    11.5
0.0    1.0    5.0    5.0
```

Sample output file

Crout method

x
1.5
2.0
0.5

L
4.0 0.0 0.0
2.0 3.0 0.0
0.0 1.0 4.667

U
1.0 0.5 0.0
0.0 1.0 0.3333
0.0 0.0 1.0