ESO208A: Computer Assignment-2

Marks: 100 Due Date: Saturday, September 10, 2016

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

Due date: Saturday, 10th September by 5:00 pm

Submit a single zip folder in the Brihaspati server under Assignment-2. The name of the zip-folder should be "your roll-number_CA2" (e.g. If your roll no. is 99999, the folder name should be '99999_CA2.zip'). The folder should include -

(i) All the computer program file(s)
(ii) Input file for the test data and output file for the test data generated by your program(s)

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
```