

## 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
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2.0	4.0	1.0	11.5
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0.0	1.0	5.0	5.0
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**Sample output file**

Crout method

x

1.5

2.0

0.5

L

4.0	0.0	0.0
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2.0	3.0	0.0
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0.0	1.0	4.667
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U

1.0	0.5	0.0
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0.0	1.0	0.3333
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0.0	0.0	1.0
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