

Instructions for preparing the solution script:

- Write your name, ID#, and Section number clearly in the very front page.
- Write all answers sequentially.
- Start answering a question (not the part of the question) from the top of a new page.
- Write legibly and in orderly fashion maintaining all mathematical norms and rules. Prepare a single solution file.
- Start working right away. There is no late submission form. If you miss the deadline, you need to use the make-up assignment to cover up the marks.

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1. A linear system is described by the following equations:

$$x_1 + 6x_2 + 2x_3 = 10$$

$$3x_1 + 2x_2 + x_3 = 6$$

$$4x_1 + 5x_2 + 2x_3 = 9.$$

Based on these equations, answer the questions below.

- (a) **[1.5 marks]** From the given linear equations, identify the matrices  $A$ ,  $x$  and  $b$  such the the linear system can be expressed as a matrix equation.
- (b) **[3 marks]** Construct the Frobenius matrices  $F^{(1)}$  and  $F^{(2)}$  from this system.
- (c) **[1.5 marks]** Compute the unit lower triangular matrix  $L$ .
- (d) **[4 marks]** Now find the solution of the linear system using LU decomposition method. Use the unit lower triangular matrix found in the previous question.

2. A linear system is described by the following equations:

$$6x_2 + 2x_3 = 10$$

$$3x_1 + 2x_2 + x_3 = 6$$

$$4x_1 + 5x_2 + 2x_3 = 9.$$

Based on these equations, answer the questions below.

- (a) **[1.5 marks]** From the given linear equations, identify the matrices  $A$ ,  $x$  and  $b$  such the the linear system can be expressed as a matrix equation.
- (b) **[1.5 marks]** Examine if the matrix  $A$  has any pivoting problem? Explain why or why not?
- (c) **[4 marks]** Write down the Augmented matrix,  $\text{Aug}(A)$ , from the given linear system, and evaluate the upper triangular matrix  $U$ . Note that you have to show the row multipliers  $m_{ij}$  for each step as necessary.
- (d) **[3 marks]** Using the upper triangular matrix found in the previous question, compute the solution of the given linear system by Gaussian elimination method.