ASSIGNMENT 2: LINEAR SYSTEM

due date: Wednesday, 28 September 2022 (23.59 WITA)

Guideline:

1. Assignments are done in groups, with members of 2 people. The group must be different than the previous one.
2. On your worksheet, write the NAME and NIM of your discussion group.
3. Assignments should be handwritten (make sure they are readable), you should use English. Avoid using red ink.
4. Assignments are scanned and collected in pdf format, then compressed to reduce the file size.
5. The naming format: **Task02_NIM1 (Full Name)_NIM2 (Full Name)**.
   Example: **Task02_2021101001 (Gede Bagus)_2021101002 (Luh Ayu)**
6. Assignment submission is done through Undiksha e-learning. Each group simply collects **one** assignment, represented by a member of the group.
7. Assignment items are assessed based on the clarity and suitability of the answers/explanations with the questions asked. Delay in submitting assignments reduces scoring points.

You hereby declare that you are ready to accept all the consequences if later found any fraud in the performance of this task.

Problems

-1.1 Elimination and substitution algorithms

1. Give a system of linear equations with two variables, and solve the system of equations using:
    1. Elimination Algorithm
    2. Substitution Algorithm

-1.2 Types of solutions of a two-variable system of linear equations

2. Give (for each) a system of linear equations with three variables, such that:
    1. It has exactly one solution
    2. It does not have a solution
    3. It has an infinitely many solutions

-1.3 Homogeneous/non-homogeneous system of linear equations

3. In your opinion, is it true that every homogeneous system of linear equations always has a solution? Explain and illustrate your answer with an example. What about a non-homogeneous system of linear equations?

-1.4 Degenerate/non-degenerate system of linear equations

4. In the lecture slide, a theorem is given which states the conditions for a degenerated system of linear equations to have a solution. Give proof of the truth of the theorem, then for each condition, give an example.

-1.5 Coefficient matrix and augmentation matrix

5. Give a system of linear equations with 4-6 variables, then construct a *coefficient matrix* and *augmentation matrix* of the system of linear equations.

-1.6 Solution written in parametric form and free variables

6. Give a system of linear equations with five or six variables that have an infinite number of solutions, and express the set of solutions in the form:
    1. Parametric
    2. Free variables

-1.7 Elementary Row Operation

7. Give a system of linear equations with 4 variables that have exactly one solution or an infinite number of solutions.

    1. Solve the system of linear equations and write the solution.
    2. Write the augmentation matrix of the system.
    3. Apply the three types of Elementary Row Operations, namely E1, E2, and E3 repeatedly on the augmentation matrix of the linear equation system, so that a matrix is obtained.
    4. Write the standard form of the system of linear equations corresponding to the matrix.
    5. Solve the system of linear equations, and check if you get the same solution as the original system of linear equations.

-1.8 Triangular form and echelon form

8. Give (for each) a system of linear equations with 4-6 variables, which has:

    1. Triangular form
    2. Echelon form
    3. Reduced-row echelon form

    Then solve **one** (can be more) the system of linear equation.

-1.9 Investigate the number of solutions to a system of linear equations

9. Give (for each) an example of a system of linear equations with more than 3 variables, which:

    1. Has exactly one solution
    2. Has no solution
    3. Has an infinitely many solutions

    Relate your example to the relationship between the number of variables and the number of linear equations in the system of linear equations (explained in the lecture).

-1.10 Elementary Row Operations to form a reduced row echelon matrix

10. Give a system of linear equations with 4 variables and 4 equations, create an augmentation matrix of the system of linear equations, then apply Elementary Row Operations to convert the matrix to its row echelon form. Write down the steps clearly.