



National University
of computer and emerging sciences



Linear Algebra (MT-1004)

Lecturer

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LECTURE # 01

Orientation

About Course , Marking Division & Class Protocols

Beginning of 1st Topic

Course Details

➤ Text Book:

Elementary Linear Algebra 12th edition By Howard Anton & Anton Kaul

➤ Reference Book (s):

- 1. Linear Algebra & its Applications By Gilbert Strang**
- 2. Coding the Matrix: Linear Algebra through Applications to Computer Science By Philip N Klein**

Marking Division

S. No	Particulars	% Marks
1.	Assignment & Presentations	20
2.	First Mid Exam	15
3.	Second Mid Exam	15
4.	Final Exam	50
	Total	100

Classroom & Course Protocols

- Be in Classroom on time
- Student who arrive more than 5 minutes late will be marked LATE & after 15 minutes as ABSENT
- Keep remember to turn off your Cell phone before entering the class
- Avoid conversation during lecture
- Submit your Assignment on time. No submission after the deadline
- Try to code your mathematical learnings into any suitable programming language and analyze the output by changing the input parameters

Linear Equation

“The equation of a straight line is known as “linear equation”.

OR

“An equation in which variable’s highest index/power is 1”

- In two dimensions a line in a rectangular xy-coordinate system can be represented by an equation of the form:

$$ax + by = c \quad (a, b \text{ not both } 0)$$

- In three dimensions a plane in a rectangular xyz-coordinate system can be represented by an equation of the form

$$ax + by + cz = d \quad (a, b, c \text{ not all } 0)$$

Linear Equation

- The general form of linear equation is:

$$a_1x_1 + a_2x_2 + \dots \dots \dots + a_nx_n = b$$

System of Linear Equations

“A group (combination) of two or more linear equations having same variables is known as System of linear equation”

OR

*“A finite set of linear equations is called a system of linear equations or, more briefly, linear system. The variables are called “**unknowns**”.*

• For Example:

i) $2x + 3y = 1$

$$x - y = 10$$

ii) $2x + 3y + z = 1$

$$x - y - z = 4$$

$$x + y + z = 10$$

System of Linear Equations

- **Non-Homogeneous Equations:** A system of linear equations having m x n order,

$$\begin{array}{ccccccc}
 a_{11}x_1 + a_{12}x_2 + & \dots & \dots & \dots & + a_{1n}x_n & = & b_1 \\
 a_{21}x_1 + a_{22}x_2 + & \dots & \dots & \dots & + a_{2n}x_n & = & b_2 \\
 \dots & \dots & & & \dots & & \dots \\
 \dots & \dots & & & \dots & & \dots \\
 a_{m1}x_1 + a_{m2}x_2 + & \dots & \dots & \dots & + a_{mn}x_n & = & b_m
 \end{array}
 \longrightarrow \text{System 1}$$

- The System 1 is known as Non-homogeneous system of linear equations.

System of Linear Equations

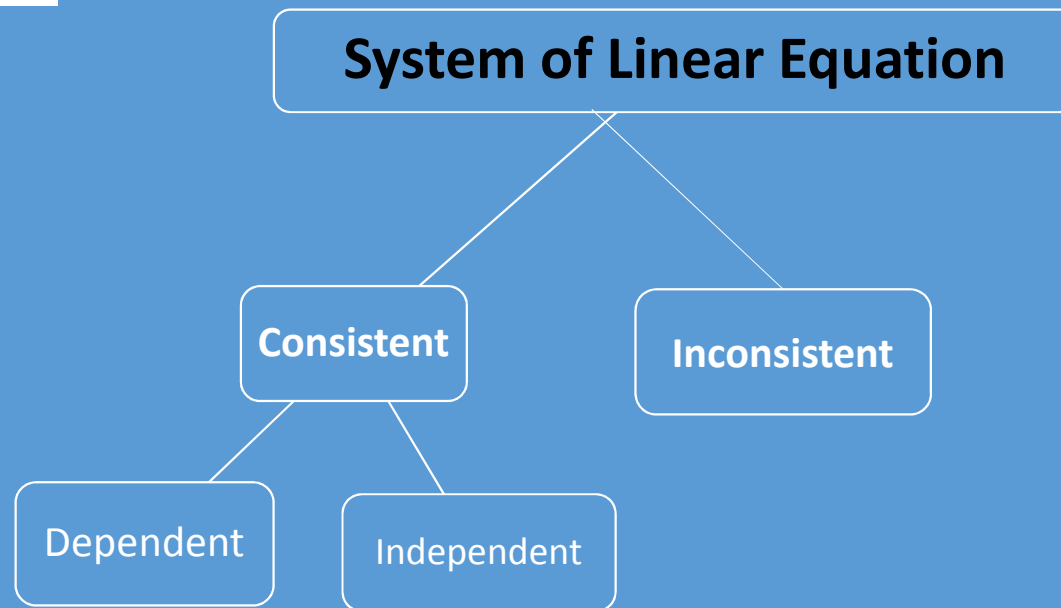
Homogeneous Equations: A system of linear equations having m x n order,

$$\begin{array}{rcl}
 a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n & = & 0 \\
 a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n & = & 0 \\
 \dots & & \dots \\
 \dots & & \dots \\
 a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n & = & 0
 \end{array} \longrightarrow \text{System 2}$$

The System 2 is known as Homogeneous system of linear equations.

TASK # 01

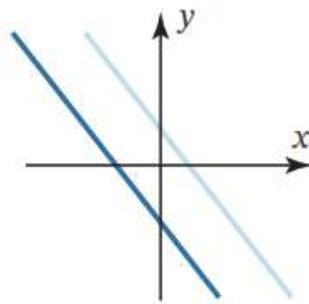
- Search any application of Linear Algebra in CS & go through it properly.
- Type a brief summary about it on MS-Word (not more than 1 page)
- Type your name & roll number too on the same page
- Attached the reference link from where you have taken the application's concept



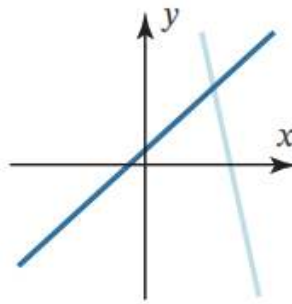
- A system of equations that has ***no solution*** is said to be ***Inconsistent***
- A system of equations that has at least ***one solution*** is said to be ***Consistent***
- Dependent system has ***many solutions***
- Independent system has ***one solution***

Types of Solution of System of Linear Equations

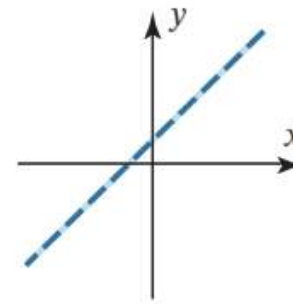
In two dimensions, For two equations having two unknowns



No solution



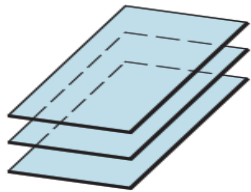
One solution



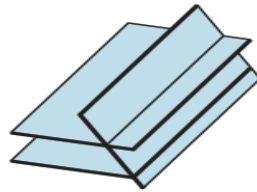
Infinitely many
solutions
(coincident lines)

Types of Solution of System of Linear Equations

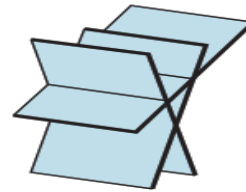
In three dimensions, For three equations having three unknowns



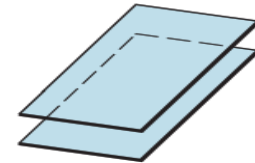
No solutions
(three parallel planes;
no common intersection)



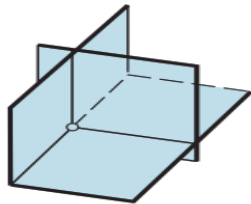
No solutions
(two parallel planes;
no common intersection)



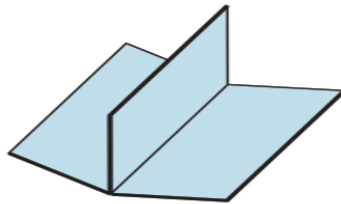
No solutions
(no common intersection)



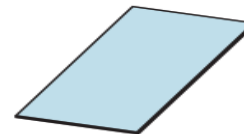
No solutions
(two coincident planes
parallel to the third;
no common intersection)



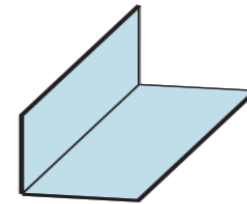
One solution
(intersection is a point)



Infinitely many solutions
(intersection is a line)



Infinitely many solutions
(planes are all coincident;
intersection is a plane)



Infinitely many solutions
(two coincident planes;
intersection is a line)