Linear Algebra and Applications

Sartaj Ul Hasan

Department of Mathematics
Indian Institute of Technology Jammu
Jammu, India - 181221

Email: sartaj.hasan@iitjammu.ac.in

Lecture 01

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Course Information

- **Instructor: Sartaj Ul Hasan**
  - Email: `sartaj.hasan@iitjammu.ac.in`
  - Office: N 513
  - Office Hours: By appointment (send me mail or talk with me).

- **Course Webpage:**

  `https://sites.google.com/site/sartajulhasan/csd001p5m`

- **Evaluation**:
  - Tests: 40 % [two tests each 20%]
  - Med-semester: 20 %
  - End-semester: 40 %

Course Information (Cont . . .)

- **Gradescope**: A paperless grading system. Use the course code 9X2B5Y to register in the course on Gradescope. Use only your IIT Jammu email address to register on Gradescope.
- **Reference Books**:
  - Linear Algebra and Its Applications, 3rd (Indian Edition), Pearson by David C Lay
  - Matrix Computations, John Hopkins University Press by Golub and Loan
  - Matrix Analysis and Applied Liner Algebra, SIAM by Carl. D. Meyer
  - Linear Algebra and Its Applications, 4th Edn, Cengange by G. Strang
- **Policy on cheating**: As per rules and regulations of the institute.
- **Policy on attendance**: As per rules and regulations of the institute.

System of Linear Equations

- A system of equations of the form:

$$\begin{aligned} a_{11}X_1 + a_{12}X_2 + \cdots + a_{1n}X_n &= b_1 \\ a_{21}X_1 + a_{22}X_2 + \cdots + a_{2n}X_n &= b_2 \\ &\vdots \\ a_{m1}X_1 + a_{m2}X_2 + \cdots + a_{mn}X_n &= b_m \end{aligned} \tag{1}$$

  where the unknowns a_{ij} and b_i are scalars and the X_j are "unknown" variables is called a **system of m linear equations in n unknowns**.

- Any (ordered) n-tuple $(s_1, s_2, \ldots, s_n)$ of scalars which satisfies all of the equations is called a **solution** of the system. The set of all solutions is called the **solution set** of the system.

Matrix Formulation

- A system of linear equations can be more compactly expressed in matrix notation as: $AX = b$, where $A = [a_{ij}]$ is called coefficient matrix, and

$$X = \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} \quad \text{and} \quad b = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{bmatrix} \quad \text{are vectors.}$$

- Recall that a vector is an ordered k-tuple of scalars. Vectors are represented in various ways: $(X_1, X_2, \ldots, X_n)$
or $[X_1, X_2, \ldots, X_n]$ (referred to as a row vector)

$$X = \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} \quad \text{(referred to as column vector).}$$