Introduction

The central problems of *Linear Algebra* is to study the properties of matrices and to investigate the solutions of linear equations.

A matrix is a collection of numbers placed on a rectangular lattice. Each *row* or *column* of a matrix is called a vector.

♣ *Example*

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 4 & -6 & 0 \\ -2 & 7 & 2 \end{bmatrix} = [\mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3], \quad \mathbf{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \quad \mathbf{b} = \begin{bmatrix} 5 \\ -2 \\ 9 \end{bmatrix}$$

Notice that the above notations could be written as

$$A \in R^{3\times3}, \ \ and \ \mathbf{a}_1 = \begin{bmatrix} 2 \\ 4 \\ -2 \end{bmatrix}, \mathbf{a}_2 = \begin{bmatrix} 1 \\ -6 \\ 7 \end{bmatrix}, \mathbf{a}_3 = \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix}, \mathbf{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \mathbf{b} = \begin{bmatrix} 5 \\ -2 \\ 9 \end{bmatrix} \in R^3$$

A linear equation is the operations of known and unknown numbers whose products are summed up to a known number.

♣ *Example* $\langle \mathbf{a}_1, \mathbf{x} \rangle = \mathbf{a}_1^t \mathbf{x} = b_1$ and $A\mathbf{x} = \mathbf{b}$

$$\begin{array}{rcrcrcr} 2x & + & y & + & z & = & 5 \\ 4x & - & 6y & & & = & -2 \\ -2x & + & 7y & + & 2z & = & 9 \end{array}, \quad \left[\begin{array}{rrr|r} 2 & 1 & 1 & 5 \\ 4 & -6 & 0 & -2 \\ -2 & 7 & 2 & 9 \end{array}\right]$$

♢ *Matlab Example*

```
>> A=[2, 1, 1; 4, -6, 0; -2, 7, 2];      % Input matrix A
>> b=[5, -2, 9]';                         % Input vector b
>> x=A\b                                  % Solve for Ax=b
```

α	θ	o	τ
β	ϑ	π	υ
γ	ι	ϖ	ϕ
δ	κ	ρ	φ
ϵ	λ	ϱ	χ
ε	μ	σ	ψ
ζ	ν	ς	ω
η	ξ		
$\spadesuit$	$\heartsuit$	$\diamondsuit$	$\clubsuit$
Γ	Λ	Σ	Ψ
Δ	Ξ	Υ	Ω
Θ	Π	Φ	

Table 1: **Greek Letters**

```
\alpha       \theta      o             \tau       \\ \hline
\beta        \vartheta   \pi           \upsilon   \\ \hline
\gamma       \iota       \varpi        \phi       \\ \hline
\delta       \kappa      \rho          \varphi    \\ \hline
\epsilon     \lambda     \varrho       \chi       \\ \hline
\varepsilon  \mu         \sigma        \psi       \\ \hline
\zeta        \nu         \varsigma     \omega     \\ \hline
\eta         \xi                                  \\ \hline
\spadesuit   \heartsuit  \diamondsuit  \clubsuit  \\ \hline
\Gamma       \Lambda     \Sigma        \Psi       \\ \hline
\Delta       \Xi         \Upsilon      \Omega     \\ \hline
\Theta       \Pi         \Phi                     \\ \hline
```