Math 290 Monday, February 22 Section M0 (plus MVP)

Tue - Exam V

Laptop! ENVELOPE

Thu - MM

Fri - MIS2E (Sage)

BYOB Movie

Ex

$$2\begin{bmatrix} 1 & 3 & 4 \\ -2 & 4 & 0 \end{bmatrix} + 4\begin{bmatrix} -3 & 2 & 0 \\ 1 & 1 & 6 \end{bmatrix}$$

linear combination

$$= \begin{bmatrix} 2 & 6 & 8 \\ -4 & 8 & 0 \end{bmatrix} + \begin{bmatrix} -12 & 8 & 0 \\ 4 & 4 & 24 \end{bmatrix}$$

$$= \begin{bmatrix} -10 & 14 & 8 \\ 0 & 12 & 24 \end{bmatrix}$$

Other Operations

Transpose

$$\begin{bmatrix} 2 & 3 & 1 \\ -6 & 4 & 5 \end{bmatrix}^T = \begin{bmatrix} 2 & -6 \\ 3 & 4 \\ 1 & 5 \end{bmatrix}$$

2×3 $\qquad$ 3×2

rows become columns

columns become rows

Defn

$$[A^T]_{ij} = [A]_{ji}$$

Complex conjugate of a matrix $\quad \overline{A}; \quad [\overline{A}]_{ij} = \overline{[A]_{ij}}$

<u>Adjoint</u> $\quad A^* = (\overline{A})^t$

sometimes $\dagger$ $\qquad$ (sometimes "adjugate")

<u>Theorem</u> $\quad (A+B)^t = A^t + B^t \qquad A, B \quad m \times n$

<u>Proof</u> $\quad$ For $1 \le i \le n, \quad 1 \le j \le m$

$$
\begin{aligned}
[(A+B)^t]_{ij} &= [A+B]_{ji} \\
&= [A]_{ji} + [B]_{ji} \\
&= [A^t]_{ij} + [B^t]_{ij} \\
&= [A^t + B^t]_{ij}
\end{aligned}
$$

scalar equality

Then by Definition ME,

$$(A+B)^t = A^t + B^t$$

matrix equality

Section MM

Matrix- Vector Product

Ex

$$\begin{bmatrix} 2 & -1 & 3 \\ 4 & 0 & 2 \end{bmatrix} \begin{bmatrix} 2 \\ -3 \\ 1 \end{bmatrix} = 2\begin{bmatrix} 2 \\ 4 \end{bmatrix} + (-3)\begin{bmatrix} -1 \\ 0 \end{bmatrix} + 1\begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

$2 \times 3 \quad 3 \times 1$

linear combination of columns of the matrix, scalars from vector

$$= \begin{bmatrix} 10 \\ 10 \end{bmatrix}$$

2×1

Ex

$$\begin{aligned} 2x_1 - x_2 + 4x_3 &= 6 \\ 9x_1 - 2x_2 + x_3 &= 12 \end{aligned} \xrightarrow{\text{SLSLC}} x_1\begin{bmatrix} 2 \\ 9 \end{bmatrix} + x_2\begin{bmatrix} -1 \\ 2 \end{bmatrix} + x_3\begin{bmatrix} 4 \\ 1 \end{bmatrix} = \begin{bmatrix} 6 \\ 12 \end{bmatrix}$$

$$\xrightarrow{\text{MVP}} \begin{bmatrix} 2 & -1 & 4 \\ 9 & 2 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 6 \\ 12 \end{bmatrix} \longrightarrow A\underset{\sim}{x} = \underset{\sim}{b} \quad // \mathcal{LS}(A, \underset{\sim}{b})$$

coefficient matrix