MA 527 Steve Bell www.math.purdue.edu/~bell/MA527

Homework discussion area: piazza.com/purdue/fall2015/ma52700

$\underbrace{99999}_{5}06482$, MA527

Exam 1:	Oct. 1	100
Exam 2:	Nov. 17	100
Final Exam:		150
Homework:		100
		450

HWK 1 : Lessons 1, 2, 3 from syllabus, due Wed, Sept. 2, 11:59 pm on BlackBoard. Scan to <u>single</u> PDF and upload. Filename: $\boxed{\text{BellSteve\_1.pdf}}$

Only 5 problems graded. 5 pts each. 25 pts.

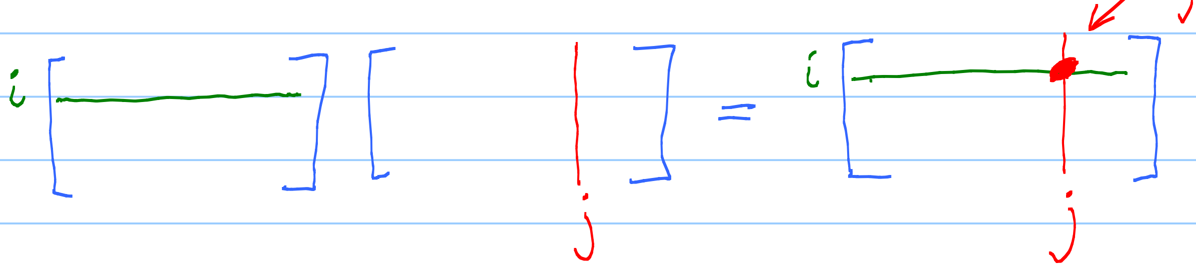
Linear Alg. 7.1, 7.2

$$\begin{cases} x_1 + x_2 + x_3 = 4 \\ x_1 \qquad - 2x_3 = 5 \\ -x_1 + 2x_2 + 3x_3 = 6 \end{cases}$$

$$\underbrace{\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & -2 \\ -1 & 2 & 3 \end{bmatrix}}_{\mathbb{A}} \underbrace{\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}}_{\vec{x}} = \underbrace{\begin{pmatrix} 4 \\ 5 \\ 6 \end{pmatrix}}_{\vec{b}}$$

$$\left[\mathbb{A} \mid \vec{b} \right] \leftarrow \text{augmented matrix } \tilde{\mathbb{A}} \text{ or } \mathbb{A}^{\#}$$

$$\mathbb{A} \underbrace{\left[\vec{x}_1, \vec{x}_2, \ldots, \vec{x}_m \right]}_{\mathbb{X}} = \underbrace{\left[\vec{b}_1, \vec{b}_2, \ldots, \vec{b}_m \right]}_{\mathbb{B}}$$



$(\text{row } i) \cdot (\text{col } j) = c_{ij}$

$\mathbb{A} = [a_{ij}]_{n \times m}$ with n = rows, m = cols

$\mathbb{A}\mathbb{B} = \mathbb{C} = [c_{ij}]$ where

$c_{ij} = \begin{bmatrix} \text{row } i \\ \mathbb{A} \end{bmatrix} \cdot \begin{bmatrix} \text{col } j \\ \mathbb{B} \end{bmatrix}$

$$\mathbb{A}_{n \times k} \, \mathbb{B}_{k \times m} = \mathbb{C}_{n \times m}$$

EX:
$$\begin{bmatrix} 1 & 2 & 3 \\ \cancel{4} & \cancel{5} & \cancel{6} \\ 7 & 8 & 9 \end{bmatrix} \begin{bmatrix} a & b & e \\ \alpha & \beta & \pi \\ A & B & \sqrt{2} \end{bmatrix} = \begin{bmatrix} 1 \cdot a + 2\alpha + 3A & \cdot & \cdot \\ \cdot & \cdot & 4e + 5\pi + 6\sqrt{2} \\ \cdot & \cdot & \cdot \end{bmatrix}$$

Big matrices:
$$\int_a^b f(x,t)\, y(t)\, dt = g(x)$$

$$\sum_{i=1}^{N} \underbrace{f(x_j, t_i)}_{\alpha_{ij}} \underbrace{y(t_i)}_{x_i} \Delta t = \underbrace{g(x_j)}_{b_j}$$

Fantastic!
$$\mathbb{A} \underbrace{\left[\vec{x}_1, \vec{x}_2, \ldots, \vec{x}_n\right]}_{\mathbb{A}^{-1}} = \underbrace{\begin{bmatrix} 1 & 0 & \cdots & 0 \\ 0 & 1 & & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & & 1 \end{bmatrix}}_{\mathbb{I}}$$

Can treat matrices like numbers! $(\mathbb{A}\mathbb{B})\mathbb{C} = \mathbb{A}(\mathbb{B}\mathbb{C})$ Yes!

$\cancel{\mathbb{A}\mathbb{B} = \mathbb{B}\mathbb{A}}$ No!

But $\mathbb{A}\mathbb{A}^{-1} = \mathbb{A}^{-1}\mathbb{A} = \mathbb{I}$. Yes! Lucky

$$10 \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 10 & 20 \\ 30 & 40 \end{bmatrix}$$

$$\left[\begin{array}{cc|c} 1-\lambda & 2 & 5 \\ 3 & 4-\lambda & 6 \end{array}\right]$$

$$\left(\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} - \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} \right) \vec{x} = \begin{pmatrix} 5 \\ 6 \end{pmatrix}$$

$$(\mathbb{A} - \lambda \mathbb{I})\vec{x} = \vec{b}$$

A^T = "transpose of A"

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

$$[a_{ij}]^T_{n\times m} = [\alpha_{ij}]_{m\times n} \text{ where } \alpha_{ij} = a_{ji}$$

Linear Transf. $\quad T(c_1\vec{x}_1 + c_2\vec{x}_2) = c_1 T\vec{x}_1 + c_2 T\vec{x}_2$

$$T\left(\begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}\right) = T\left(a_1\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} + a_2\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} + a_3\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}\right)$$

$$= a_1 T\vec{e}_1 + a_2 T\vec{e}_2 + a_3 T\vec{e}_3$$

$$= \underbrace{[T\vec{e}_1, \ T\vec{e}_2, \ T\vec{e}_3]}_{B}\begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$$

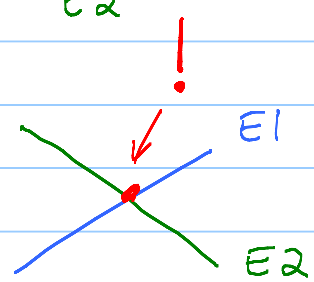
$$T\vec{a} = B\vec{a} \qquad \text{Aha!}$$

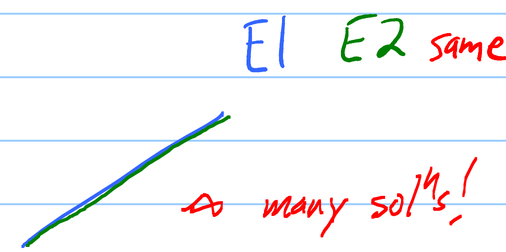
$$T \sim B$$

$$T_1 \circ T_2 \sim B_1 B_2$$

$$\begin{cases} ax + by = A & E1 \\ cx + dy = B & E2 \end{cases}$$

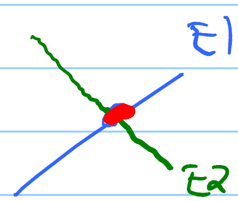
<u>$A=0, B=0$</u>:

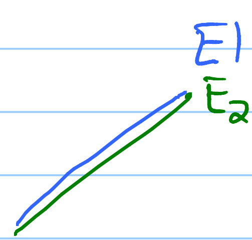


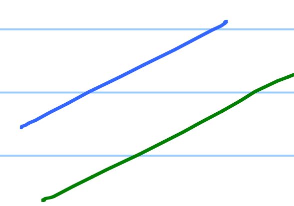


∞ many sol'ns!

A, B not both 0







1 sol'n

∞ many sol'ns

no solutions!