EE16A Gireeja Ranade

Discussion Poll + Rebalancing.

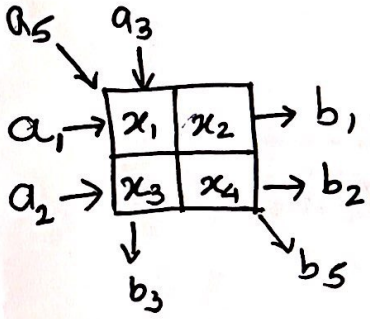
HW0 due yesterday.

Self-grades due tonight

HW1 due Friday midnight

HW Party tomorrow.

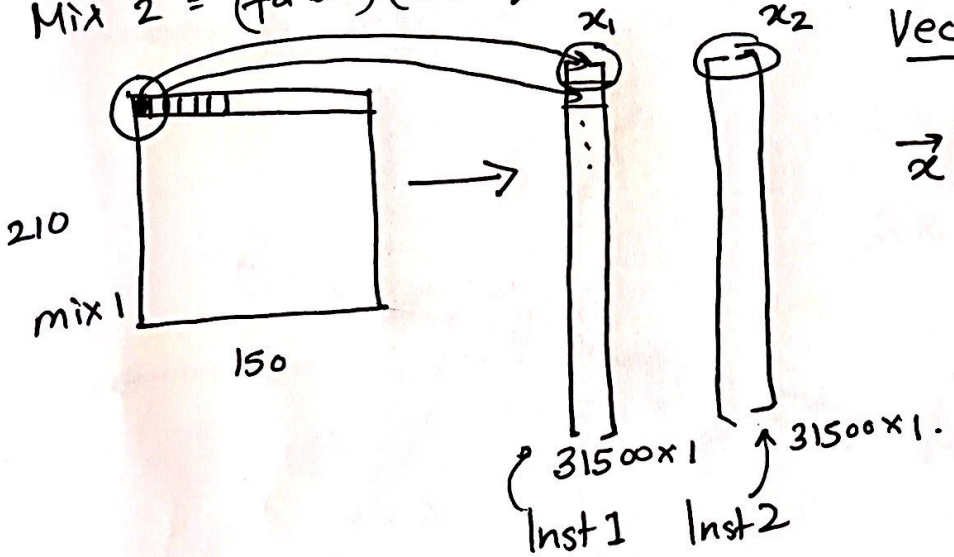
Today: Gaussian Elimination to Systems of Linear Equations.



$$a_1x_1 + a_1x_2 = b_1$$
$$a_2x_3 + a_2x_4 = b_2$$
$$a_3x_1 + a_3x_3 = b_3$$
$$a_5x_1 + a_5x_4 = b_5.$$

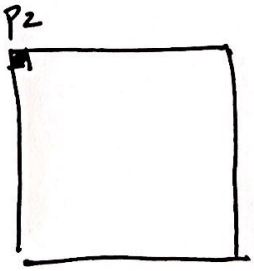
Mix 1 = (fa 1a)(Ins 1) + (f2a)(Inst2)

Mix 2 = (fa 1b)(Inst1) + (f2b)(Inst2)



Vector: Orderd list of numbers.

$$\vec{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$$



$$P1 = (f1a)\cdot x_1 + (f2a)\cdot x_2$$
$$P2 = (f1b)\cdot x_1 + (f2b)\cdot x_2$$

Gaussian Elimination.

$$x + 4y = 6 \quad (E1)$$
$$2x - y = 3 \quad (E2).$$

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

"Augmented matrix"

$(E2) - 2\cdot(E1)$

$\downarrow R2 - 2(R1)$

$$2x - y - 2x - 8y = 3 - 12 = -9$$

$$-9y = -9$$

$$\boxed{y = +1}$$

$$\left[\begin{array}{cc|c} 1 & 4 & 6 \\ 0 & -9 & -9 \end{array}\right]$$

Upper triangular matrix.

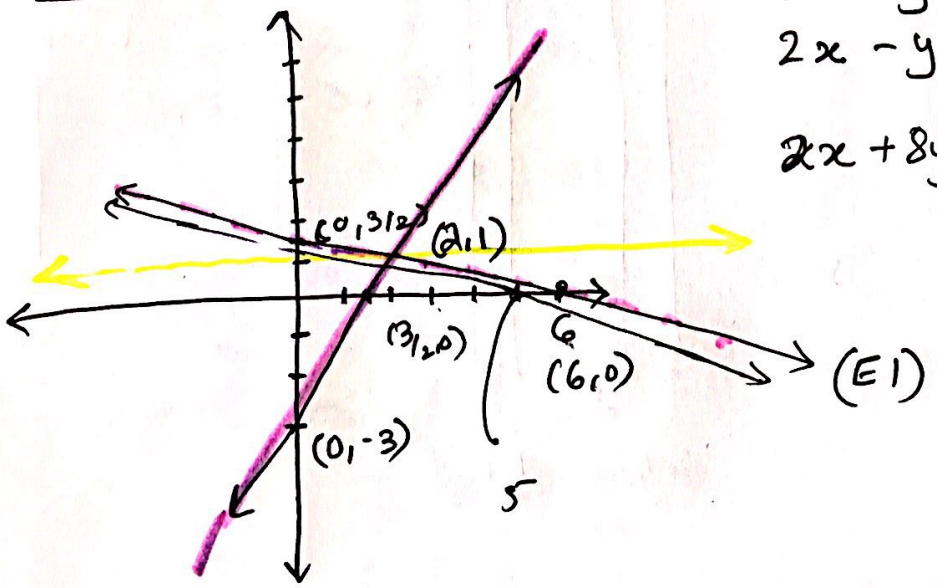
Gaussian Elimination.

$$\begin{bmatrix} 1 & 4 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \end{bmatrix}$$

matrix vector vector.

Geometric Perspective

$$x + 4y = 6 \quad (E1)$$
$$2x - y = 3. \quad (E2)$$
$$2x + 8y = 12 \quad (E3)$$



$$2y + z = 1 \quad (E1)$$
$$2x + 6y + 4z = 10 \quad (E2)$$
$$x - 3y + 3z = 14 \quad (E3).$$

Goal: Make UT.

$$\left[\begin{array}{ccc|c} 0 & 2 & 1 & 1 \\ 2 & 6 & 4 & 10 \\ 1 & -3 & 3 & 14 \end{array}\right]$$

Strategy: Use (E1) to eliminate variables from (E2), (E3).

$\updownarrow$ SWAP $(R2) \leftrightarrow (R1)$.

$$\left[\begin{array}{ccc|c} 2 & 6 & 4 & 10 \\ 0 & 2 & 1 & 1 \\ 1 & -3 & 3 & 14 \end{array}\right]$$

$\updownarrow$ Divide (R1) by 2.

$$\left[\begin{array}{ccc|c} 1 & 3 & 2 & 5 \\ 0 & 2 & 1 & 1 \\ 1 & -3 & 3 & 14 \end{array}\right]$$

$\updownarrow$ $(R3) - (R1)$

$$\left[\begin{array}{ccc|c} 1 & 3 & 2 & 5 \\ 0 & 2 & 1 & 1 \\ 0 & -6 & 1 & 9 \end{array}\right]$$

$\updownarrow$ $3 \cdot (R2) + (R3)$

$$\left[\begin{array}{ccc|c} 1 & 3 & 2 & 5 \\ 0 & 2 & 1 & 1 \\ 0 & 0 & 4 & 12 \end{array}\right]$$

$x = 2$

$2y + 3 = 1$, $y = -1$

$z = 3$.

① Multipy by scalar

② Swapping

③ Adding a scalar multiple of one row to another.

$$x + 4y = 6 \quad (E1)$$
$$2x + 8y = 12 \quad (E3).$$

$$\left[\begin{array}{cc|c} 1 & 4 & 6 \\ 2 & 8 & 12 \end{array}\right]$$

↓

$$\left[\begin{array}{cc|c} 1 & 4 & 6 \\ [redacted] & 0 & 0 \end{array}\right]$$

↑ Pivot

WARNING.

$$x + 4y = 6 \quad (E1)$$
$$2x + 8y = 10 \quad (E4).$$

$$\left[\begin{array}{cc|c} 1 & 4 & 6 \\ 2 & 8 & 10 \end{array}\right]$$

↓

$$\left[\begin{array}{cc|c} 1 & 4 & 6 \\ 0 & 0 & -2 \end{array}\right]$$