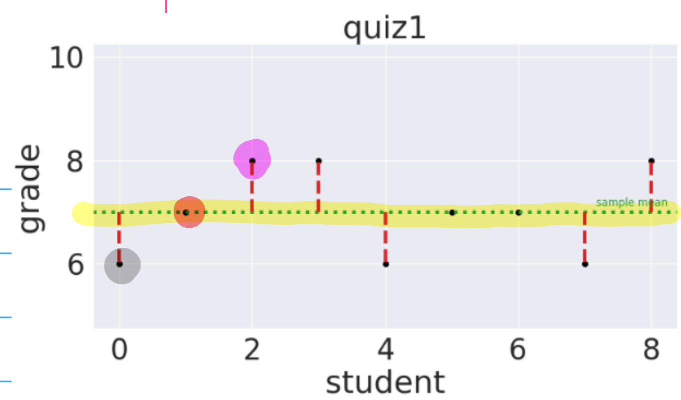


COMPUTING SAMPLE VARIANCE

$$\hat{\sigma}^2 = \frac{1}{N-1}\sum_{i=1}^{N}\left(x_i-\bar{x}\right)^2$$

TOTAL NUMBER OF OBSERVATIONS

SAMPLE MEAN

OBSERVATION i (FOR EXAMPLE x_0 IS STUDENT 0'S SCORE)

$$\hat{\sigma}^2 = \frac{1}{9-1}\left[(6-7)^2 + (7-7)^2 + (8-7)^2 + \dots\right]$$

In Class Assignment B

set A: 4, 6, 8, 6, 2, 10

set B: -100, 100, -100, 100

SAMPLE MEAN

$$\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i$$

$$= \frac{4+6+8+6+2+10}{6}$$

$$= 36/6 = 6$$

SAMPLE VARIANCE

$$\hat{\sigma}^2 = \frac{1}{N-1}\sum_{i=1}^{N}\left(x_i-\bar{x}\right)^2$$

$$= \frac{1}{6-1}\left[(4-6)^2 + (6-6)^2 + (8-6)^2 + (6-6)^2 + (2-6)^2 + (10-6)^2\right]$$

$$= \frac{1}{5}\left(4 + 0 + 4 + 0 + 16 + 16\right)$$

$$= \frac{1}{5}\cdot 40 = 8$$

Anatomy of a Covariance Matrix

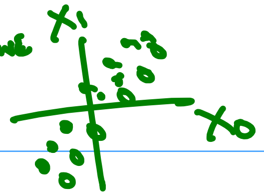
Small x_0 var
Small horz spread

Large x_0 var
Big horz spread

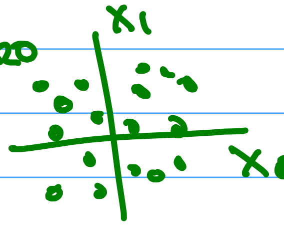
$$\Sigma = \begin{bmatrix} \text{cov}(x_0, x_0) & \text{cov}(x_0, x_1) \\ \text{cov}(x_1, x_0) & \text{cov}(x_1, x_1) \end{bmatrix}$$

Two entries =

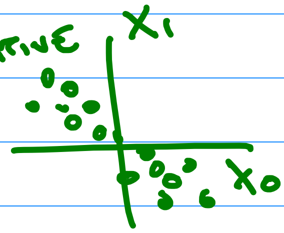
Positive



Zero

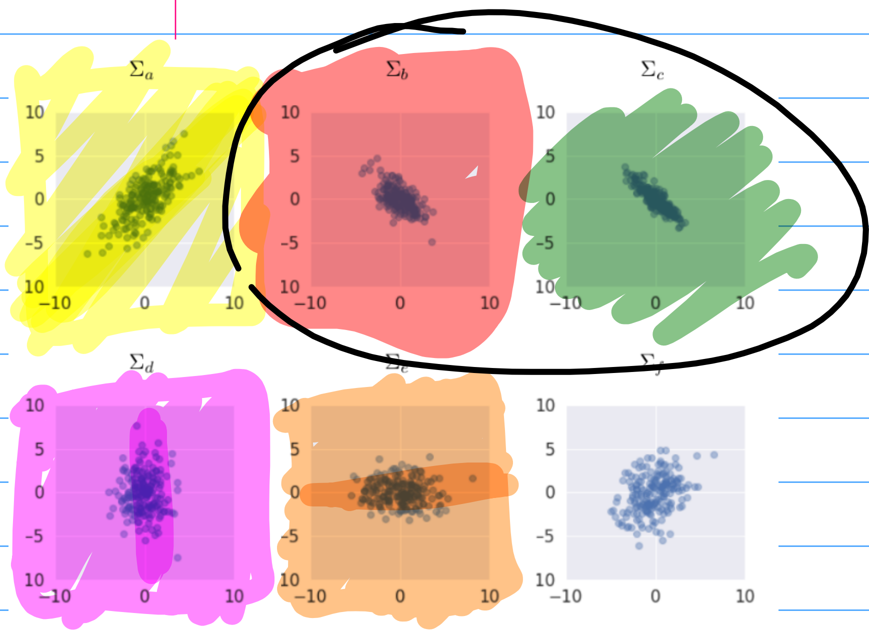


Negative



Small x_1 var
Small vert spread

Large x_1 var
Large vert spread



$\Sigma_0 = \begin{bmatrix} 5 & 0 \\ 0 & 2 \end{bmatrix}$, $\Sigma_1 = \begin{bmatrix} 2 & -1.3 \\ -1.3 & 2 \end{bmatrix}$, $\Sigma_2 = \begin{bmatrix} 2 & 0 \\ 0 & 5 \end{bmatrix}$

$\Sigma_3 = \begin{bmatrix} 4 & 3 \\ 3 & 5 \end{bmatrix}$, $\Sigma_4 = \begin{bmatrix} 4 & 1 \\ 1 & 5 \end{bmatrix}$, $\Sigma_5 = \begin{bmatrix} 2 & -1.7 \\ -1.7 & 2 \end{bmatrix}$,