CSE 572

6/9/17

How many samples are needed to ensure that at least one ball is selected from every bin? (10 bins)

$P(b=3)$ for any given selection $= \frac{1}{10}$

$P(b=i) = \frac{1}{10}$

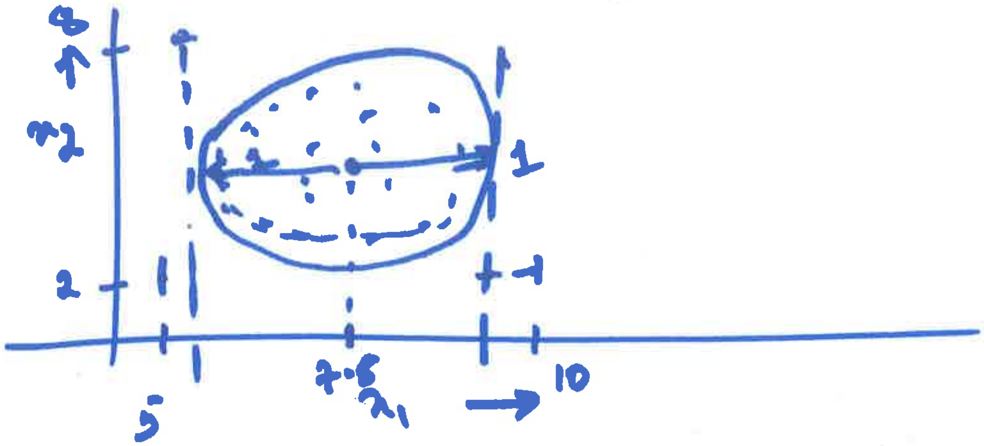
$1 - P(b=i) = \frac{9}{10}$

$P(b \neq i \mid N \text{ samples}) = \left(\frac{9}{10}\right)^N$

$P(b=i \text{ at least once}) = 1 - \left(\frac{9}{10}\right)^N$

$P(\text{at least one from every bin})$

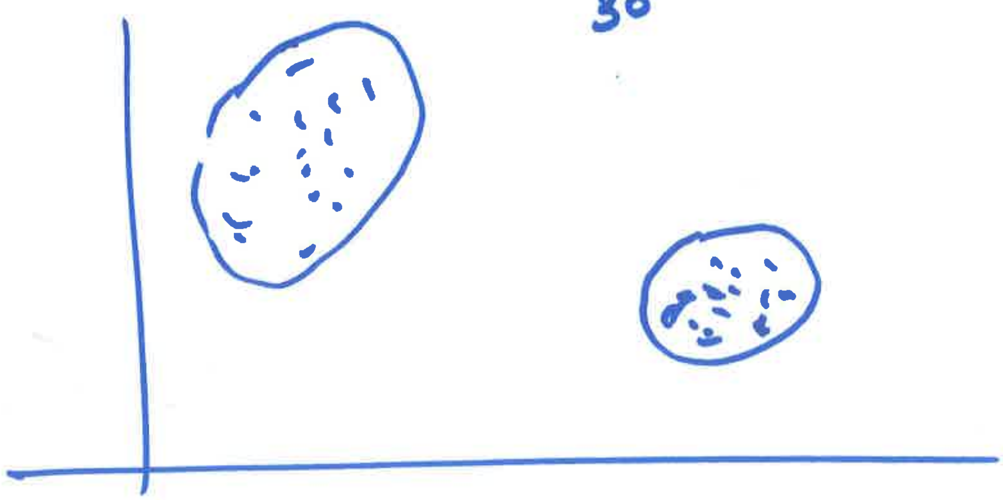
$= \left(1 - \left(\frac{9}{10}\right)^N\right)^{10}$

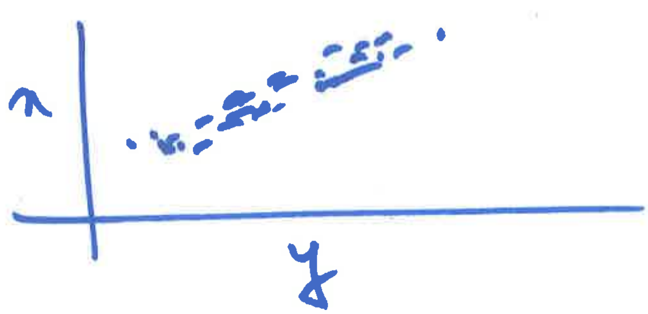


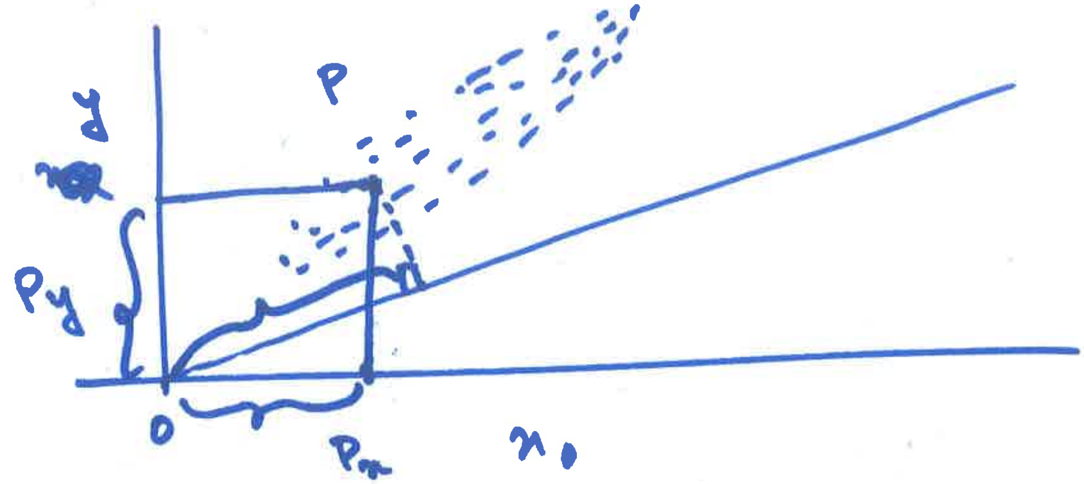
$$\frac{2}{10-5} \times 100$$

$$= \frac{2}{5} \times 100 = 40\%$$

$$\frac{3.14 \times 1}{5 \times 6} \times 100 \rightarrow \frac{3.14}{30} \times 100 \approx 11\%$$







$x \rightarrow$ random variable

$$E(x) = \sum_{\forall x} x \, p(x)$$

$$\cancel{\sigma(x,x) = E(x - E(x)) \cdot E(x - E(x))}$$

$$\sigma(x,x) = E\left[(x - E(x))(x - E(x))\right]$$

$$\sigma(y,y) = E\left[(y - E(y))^2\right]$$

$$\sigma(x,y) = E\left((x - E(x))(y - E(y))\right)$$

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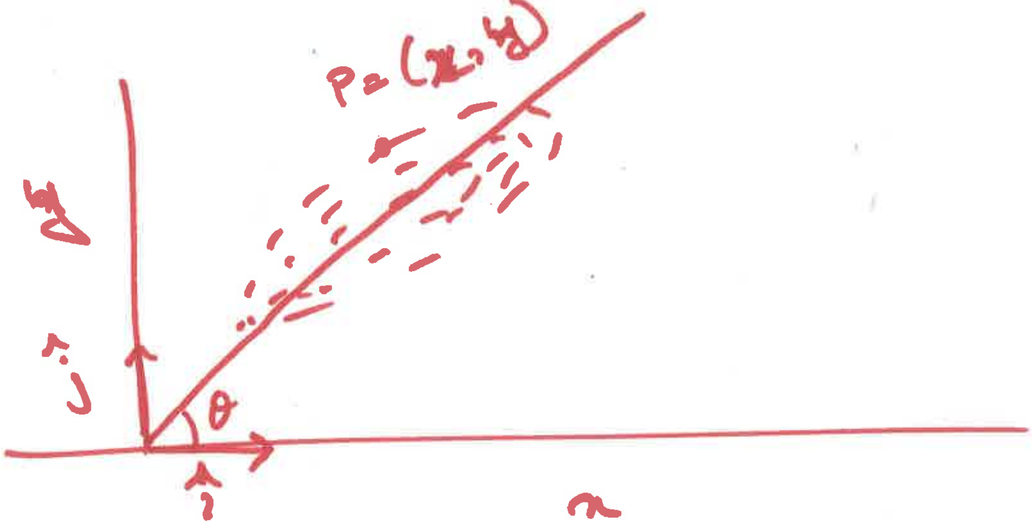
$$\mathrm{cov}(x,y) = \begin{bmatrix} \sigma(x,x) & \sigma(x,y) \\ \sigma(y,x) & \sigma(y,y) \end{bmatrix}$$



$$\vec{v} = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$$

$$[\vec{v}]^T \vec{P}$$

$$\vec{P} = x\hat{i} + y\hat{j}$$

$$\vec{v} = \begin{bmatrix} \cos\theta \\ \sin\theta \end{bmatrix} \qquad \vec{P} = \begin{bmatrix} x \\ y \end{bmatrix}$$

$$\begin{matrix} x_1 & y_1 \\ x_2 & y_2 \\ \vdots & \\ x_n & y_n \end{matrix} \qquad [\vec{v}]^T D$$

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Projection of data set D on line $\vec{v}$

$$= [\vec{v}]^T D$$

$$D = \begin{bmatrix} x_1 & x_2 & \cdots & x_n \\ y_1 & y_2 & \cdots & y_n \end{bmatrix}$$

$$A\vec{v} = \lambda\vec{v}$$

$n \times n \quad n \times 1 \quad 1 \times 1 \quad n \times 1$

$= n \times 1$

$$A\vec{v} - \lambda\vec{v} = 0$$

$$(A - \lambda I)\vec{v} = 0$$

$$\det(A - \lambda I) = 0$$