$E[X]$

$\approx$ average of many observations of X

$$P(X=1) = 0.7, \quad P(X=0) = 0.3$$

$$E[X] = ? \qquad 0.7$$

$$= 0 \cdot (0.3) + 1(0.7)$$

$$= 0.7$$

Suppose $Var(X)=1$

X is Normal $E(X)=10$

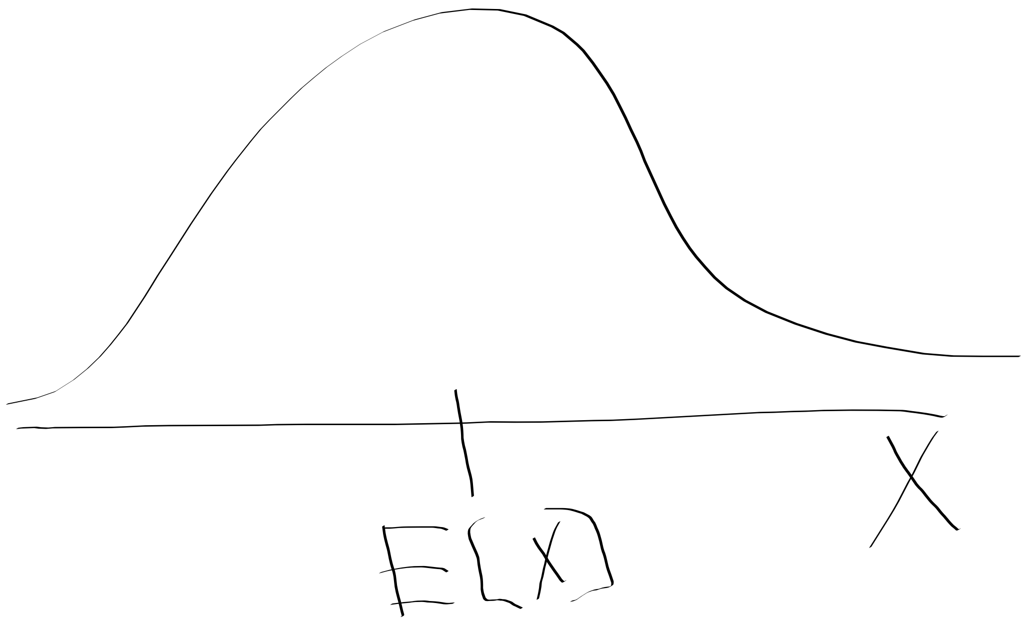
Y is Normal $E(Y)=-10$

$Var(Y)=1$

$$Var(X)=EX^2-[E(X)]^2$$

$$Var(2X)=E(2X)^2-(E(2X))^2$$
$$=4EX^2-4[EX]^2$$
$$=4(EX^2-E(X)^2)$$

$$E[aX+bY+c]$$
$$= aE[X]+bE[Y]+c$$
$$Var(aX+bY+c)$$
$$= a^2 Var(X)+b^2 Var(Y)$$
if independent X and Y


E(X)
X

Formula

$$E[X] = \begin{cases} \displaystyle\sum_{\text{all } x} x\,P(X=x) & \text{discrete} \\ \displaystyle\int_{-\infty}^{\infty} x\,\underbrace{f(x)}_{\text{pdf}}\,dx & \text{ctns} \end{cases}$$

$$SD(X) = \sqrt{Var(X)}$$

$$\sigma = \sqrt{\sigma^2}$$

$$Var(X) = E\left[\left(X - E[X]\right)^2\right]$$

$$= E[X^2] - \left(E[X]\right)^2$$

What is

$E[2X] = 20$ $\quad$ $E[2X+3Y+4] = -6$ ($2\cdot 10 + 3(-10) + 4$)

$E[X+Y] = 0$ $\quad$ $E[X\cdot Y] = -100$ if X and Y are indep.

$E[X+4] = 14$ $\quad$ $\mathrm{Var}(2X) = 4\cdot 1$

$\mathrm{Var}(X+Y) = 2$ $\quad$ $\mathrm{Var}(X+4) = 1$

if X and Y are independent

$$E[X \cdot Y] = E[X]E[Y]$$

if X and Y are independent

Matrix Notation

$\vec{X}$ $\vec{A}$ $\vec{x}$

$n \times 1$ $n \times 2$