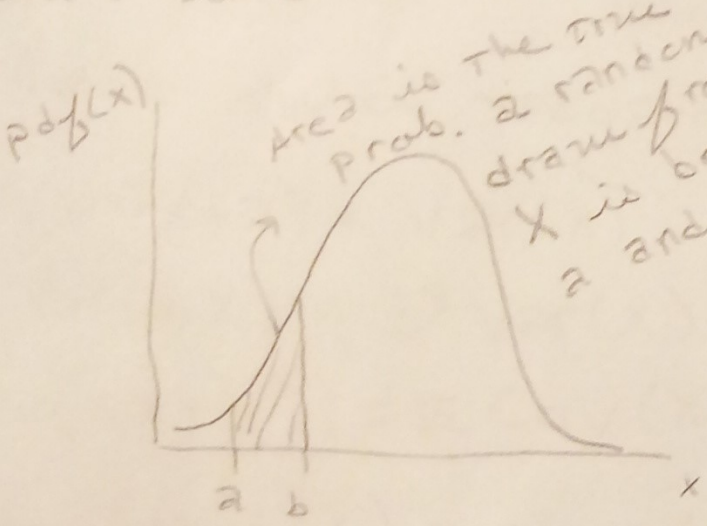
Topic One: Variances, Expectations, ...

Population v. Samples

Say X and Y are true random variables that we take n draws from.



Population ("True")	Sample Estimate
$E[X]$ "expectation"	$\frac{1}{n}\sum_{i=1}^{n} x_i$ "sample mean"
$Var[X] = E[(X - E(X))^2]$	$\frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \frac{1}{n}\sum_{i=1}^{n} x_i\right)^2$
$Cov[X,Y] = E[(X-E(X))(Y-E(Y))]$	$\frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \frac{1}{n}\sum_{i=1}^{n} x_i\right)\left(Y_i - \frac{1}{n}\sum_{i=1}^{n} Y_i\right)$
$Corr[X,Y] = \frac{Cov[X,Y]}{\sqrt{Var(X)\,Var(Y)}}$	$\frac{\sum_{i=1}^{n}\left(x_i - \frac{1}{n}\sum_{i=1}^{n} x_i\right)\left(Y_i - \frac{1}{n}\sum_{i=1}^{n} Y_i\right)}{\sqrt{\sum_{i=1}^{n}\left(x_i - \frac{1}{n}\sum_{i=1}^{n} x_i\right)^2 \sum_{i=1}^{n}\left(Y_i - \frac{1}{n}\sum_{i=1}^{n} Y_i\right)^2}}$ (Pearsons)

? You do not need to know this.