# Lec 11/21

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Common stats:

$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$

$\tilde{X}$ = median

$S^2 = \dfrac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}$

$X_1 \le \cdots \le X_n$ order statistics.

8.2: $\underbrace{\text{Sampling distribution}}$ of the sample mean.

$\bar{X} \leftarrow$ RV. $\longrightarrow$ Dist. of a statistic.

if $X_i \overset{iid}{\sim} N(\mu, \sigma^2)$

$\bar{X} \sim N(\mu, \frac{\sigma^2}{n})$

In general, if $X_1, \ldots, X_n$ are a $\overbrace{\text{random sample}}^{\text{iid}}$ from a population with mean $\mu$ and variance $\sigma^2$,

then $E(\bar{X}) = \mu = E(X_i)$

and $Var(\bar{X}) = \frac{\sigma^2}{n} = \frac{Var(X_i)}{n}$

$E(\bar{X}) = E(\frac{1}{n}\sum X_i) \overset{\text{id dist.}}{=} \frac{1}{n} \cdot n\mu = \mu.$

$Var(\bar{X}) = Var(\frac{1}{n}\sum X_i) = \frac{1}{n^2} Var(\sum X_i) \underset{\text{ind, id dist.}}{=} \frac{1}{n^2}\sum Var(X_i) = \frac{1}{n^2} \cdot n \cdot \sigma^2 = \frac{\sigma^2}{n}$

as $n \to \infty$, $Var(\bar{X}) = \frac{\sigma^2}{n} \to 0$