NOTES: Sampling Distributions

- \( n \) = sample size
- \( \bar{x} \) = sample mean = average of a quantitative variable describing a SAMPLE
- \( \mu \) = population mean = average of a quantitative variable describing the POPULATION
- \( \hat{p} \) = proportion of the SAMPLE with trait
  \[ \hat{p} = \frac{\text{number of individuals in the SAMPLE which have trait}}{n} \]
- \( p \) = proportion of the POPULATION with trait
  \[ p = \frac{\text{number of individuals in the POPULATION which have trait}}{\text{populationsize}} \]

Statistic: a number which describes a sample.
Examples: \( \bar{x}, S_x, \hat{p}, n \)

Parameter: a number which describes a population.
Examples: \( \mu, \sigma, p \)

Sampling Distribution: The sampling distribution of a statistic is the distribution of values taken by the statistic in all possible samples of the same size from the same population.

Unbiased Estimator: A statistic used to estimate a parameter is unbiased if the mean of its sampling distribution is equal to the true value of the parameter being estimated.
Example: \( \mu(\hat{p}) = p \)
Example: \( \mu(\bar{x}) = \mu \)

NOTES: z-scores for distributions

In general, the z-score for a value in a sampling distribution is the value minus the mean of the distribution divided by the standard deviation of the distribution. In notation: \( \frac{\text{value} - \text{mean}}{\text{standard deviation}} \). This concept is the origin for the different sampling distribution z-score formulas seen in the table below.

<table>
<thead>
<tr>
<th>Distribution</th>
<th>z-score</th>
<th>z-score with replaced formulas</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x )</td>
<td>( \frac{x - \mu}{\sigma} )</td>
<td>( \frac{x - \mu}{\sigma} )</td>
</tr>
<tr>
<td>( \bar{x} )</td>
<td>( \frac{\bar{x} - \mu(\bar{x})}{SD(\bar{x})} )</td>
<td>( \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} )</td>
</tr>
<tr>
<td>( \hat{p} )</td>
<td>( \frac{\hat{p} - \mu(\hat{p})}{SD(\hat{p})} )</td>
<td>( \frac{\hat{p} - p}{\sqrt{\frac{p(1-p)}{n}}} )</td>
</tr>
</tbody>
</table>