A new statistic in a binomial experiment:

Sample proportion \( \hat{p} = \frac{x}{n} \) of successes

This is different from \( p \):

\[ p = \text{population proportion of success,} \]

\( \hat{p} \) = the statistic that estimates the parameter \( p \).

Each \( x \) corresponds to a \( \hat{p} = \frac{x}{n} \) so they have the same probabilities. They are both binomial.

But binomial probabilities are approx. normal if \( np \geq 10 \) & \( n(1-p) \geq 10 \).

\[ E(\hat{p}) = E\left(\frac{x}{n}\right) = E\left(\frac{1}{n} \cdot x\right) = \frac{1}{n} E(x) = \frac{1}{n} np = p \]

So \( \hat{p} \) is an unbiased estimator of \( p \).

Also

\[ \text{Var}(\hat{p}) = \text{Var}\left(\frac{x}{n}\right) = \text{Var}\left(\frac{1}{n} \cdot x\right) = \frac{1}{n^2} \text{Var}(x) = \frac{1}{n^2} \cdot npq \]

So the standard deviation is the square root of variance:

\[ \sigma_{\hat{p}} = \frac{\sqrt{pq}}{\sqrt{n}} = \text{standard error of } \hat{p} \]

Values...