Finishing 7.2 → Binomial Experiments ↓ Estimates of Population Proportions.

→ Sample Proportion: $\hat{p} = \frac{x}{n}$ (varies from sample to sample)

The sampling distribution of sample proportions is a collection of all $\hat{p}$ values from random samples of size n. What we know:

→ The $\hat{p}$ distribution is appx. normal if $np \geq 10$ & $nq \geq 10$.

→ Mean of $\hat{p}$ values is the population proportion, p:

$$\mu_{\hat{p}} = E(\hat{p}) = p$$

so $\hat{p}$ is an unbiased estimate of p.

→ The variance of $\hat{p}$ values is

$$Var(\hat{p}) = \frac{pq}{n}.$$

→ The standard error (deviation) of $\hat{p}$ values is the square root of variance:

$$\sigma_{\hat{p}} = \sqrt{\frac{pq}{n}}.$$

→ The maximum error in an estimate, $\hat{p}$, of p is

$$E = Z_{\alpha/2} \cdot \left(\begin{matrix}\text{std} \\ \text{error}\end{matrix}\right) = Z_{\alpha/2} \cdot \sqrt{\frac{pq}{n}}.$$

→ Confidence Interval

$$\hat{p} - E < p < \hat{p} + E$$

z-score of $\hat{p}$

$$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}} = \frac{\hat{p} - \mu_{\hat{p}}}{\sigma_{\hat{p}}}$$