Lesson Learning Objectives

LO 1. Define population proportion p (parameter) and sample proportion $\hat{p}$.

LO 2. Calculate the sampling variability of the proportion, the standard error, as $SE = \sqrt{\frac{p(1-p)}{n}}$, where p is the population proportion.

- Note that when the population proportion p is not known (almost always), this can be estimated using the sample proportion, $SE = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$.

LO 3. Recognize that the Central Limit Theorem (CLT) is about the distribution of point estimates, and that given certain conditions, this distribution will be nearly normal. In the case of the proportion the CLT tells us that if

- the observations in the sample are independent,
- the sample size is sufficiently large (checked using the success/failure condition: $np \geq 10$ and $n(1-p) \geq 10$,

then the distribution of the sample proportion will be nearly normal, centered at the true population proportion and with a standard error of $SE = \sqrt{\frac{p(1-p)}{n}}$.

$$\hat{p} \sim N\left(mean = p, SE = \sqrt{\frac{p(1-p)}{n}}\right)$$

LO 4. Note that if the CLT doesn't apply and the sample proportion is low (close to 0) the sampling distribution will likely be right skewed, if the sample proportion is high (close to 1) the sampling distribution will likely be left skewed.

LO 5. Remember that confidence intervals are calculated as

$$\text{point estimate} \pm \text{margin of error}$$

and test statistics are calculated as

$$\text{test statistic} = \frac{\text{point estimate - null value}}{\text{standard error}}$$

LO 6. Note that the standard error calculation for the confidence interval and the hypothesis test are