Free Throws

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Mr. Merrick claims that he is an 80% free throw shooter. To prove his skills he shoots 50 free throws and makes 32 shots. Use statistical inference to make a claim about whether or not Mr. Merrick is as good as he says.

- State procedure and show conditions for inference are met.

Solution: Here we will be using a one sample Z-test for the population proportion. This is appropriate as our conditions for inference are met:

Random Sampling: Here the shots are clearly random.

Independence: Here we assume the shots to be independent of each other. Note that this might not be entirely true in reality

Normality: We may assume that the sampling distribution for $\hat{p}$ is normal as we have $np_0 = 50(.8)$ and $n(1 - p_0) = 50(.2)$ are both greater than 10.

- State null and alternate hypothesis

Solution:

$$H_0 : p = 0.8$$

$$H_a : p \leq 0.8$$

We use a left-tailed alternative hypothesis because our sample proportion of 0.64. Our data and context doesn't give us any reason to use a two-tail alternative.

- Calculate standardized test statistic and p-value

Solution: Under our null hypothesis we have $\hat{p} \sim \text{Normal}\left(\mu_{\hat{p}} = 0.8, \sigma_{\hat{p}} = \sqrt{\frac{0.8(0.2)}{50}}\right)$ our z test statistics is given by:

$$\begin{aligned} z &= \frac{0.64 - 0.80}{0.0566} \\ &= -2.82 \end{aligned}$$

We can now calculate the p-value

$$\begin{aligned} P(Z \leq -2.82) &= \text{normalcdf}(-1000, -2.82, 0, 1) \\ &= 0.002 \end{aligned}$$

- What conclusions can we make?

Solution: Here we have a p-value of $0.002 < \alpha = 0.05$. This is strong evidence that Mr. Merrick is less than a 80% free throw shooter.