

Mini Math

February 2

1. A student claims that they can taste the different colours of skittles. In other words that they can identify skittles better in a blind taste test than someone choosing skittle colours at random. The student blindly tastes 150 skittles and correctly identifies 97 of them. Conduct an appropriate test to see if the student's claim is reasonable. (Note that there are 5 types of skittles)

Solution: State:

- p - the true proportion that the student guesses correctly.
- $\hat{p} = \frac{97}{150}$ - the proportion of skittles the student guesses correct from the sample.
- $\alpha = 0.05$.
- $H_0 : p = 0.2, H_a : p > 0.2$.

Plan: Here we will use a one sample z -test for p . Let's check conditions:

Random: Random sample of skittles, so we can generalize to all skittles.

Independence: $150 \leq 10\%$ of all skittles so sampling without replacement is okay.

Normality: We have $150(0.2) \geq 10$ and $150(0.8) \geq 10$ so the sampling distribution for \hat{p} is approximately normal.

Do: $z = 13.68$, $p\text{-value} \approx 0$. Need to show calculations.

Conclude: Assuming H_0 is true there is an approximately 0 probability of getting \hat{p} of 0.647 or greater purely by chance. Because $0 < 0.05$ we reject H_0 and have convincing evidence that the student can taste the difference between skittles.

2. For question 1 interpret in context what is meant by a Type I error, a Type II Error, and the power of the statistical test.

Solution: Type I error: We assume that the student can taste the colours of skittles when in reality they cant.

Type II error: We assume that the student cannot discriminate between skittle colours, when in reality they can.

Power: This is the probability that we detect that a student can taste the difference in skittles, given that they can in fact taste the difference.

3. A web blogger constructs a 95% confidence interval for the proportion of customers that donate via patreon. The interval is from 0.32 to 0.43.
- (a) Interpret the confidence interval in context.

Solution: Leif is 95% confident that the true proportion of customers that visit the website and donate on Pateron is captured on the interval from 0.32, to 0.43.

- (b) If the website has approximately 1000 visitors a month and the average Patreon donation is \$5, use the confidence interval in part a) to construct an interval estimate for the money generated by the blog in a month.

Solution: Our interval estimate is constructed as follows.

$$[0.32(1000)5, 0.43(1000)5]$$

$$[1600, 2150]$$

We are 95% confident that the revenue generated by the website is contained on the interval from \$1600 to \$2150.