Can you Taste the Rainbow?

September 2, 2022

In this class we are interested in estimating the proportion of skittles someone can guess.

1. If someone was randomly guessing a colour, what proportion would we expect to be guessed correctly by an individual?

> **Solution:** This a random guess out of six options {Red, Yellow, Green, Purple, Orange}. We would expect them to guess correctly $\frac{1}{5}$ of the time.

2. What is the **parameter** we are interested in studying here?

> **Solution:** p: the proportion of skittles an individual guesses correctly.

3. What is the **statistic** we are interested in studying here?

> **Solution:** $\hat{p}$: This is the proportion of skittles an individual can guess correctly based on our experiment.

For our experiment we would like to test two hypothesis.

- The **null hypothesis** is the outcome that we would expect under the 'status quo'. In this case The null hypothesis is that an individual cannot correctly identify a skittle.
- the **alternative hypothesis** is the outcome that we would expect if there is a significant 'effect'. In this case that an individual can taste the rainbow.

We can write out hypothesis as follows:

$$H_0 : p = \frac{1}{5} \quad \text{(cannot taste the rainbow, and is just randomly guessing)}$$

$$H_0 : p > \frac{1}{5} \quad \text{(can taste the rainbow, and does better than a random guess)}$$

4. Assuming that an individual is not able to taste the rainbow. Explain how using a random number generator we may simulate one 'guess' when tasting a skittle.

Solution: We assign the numbers 1 as a correct guess and 2-5 as incorrect guesses. Each generated number simulates one taste test.

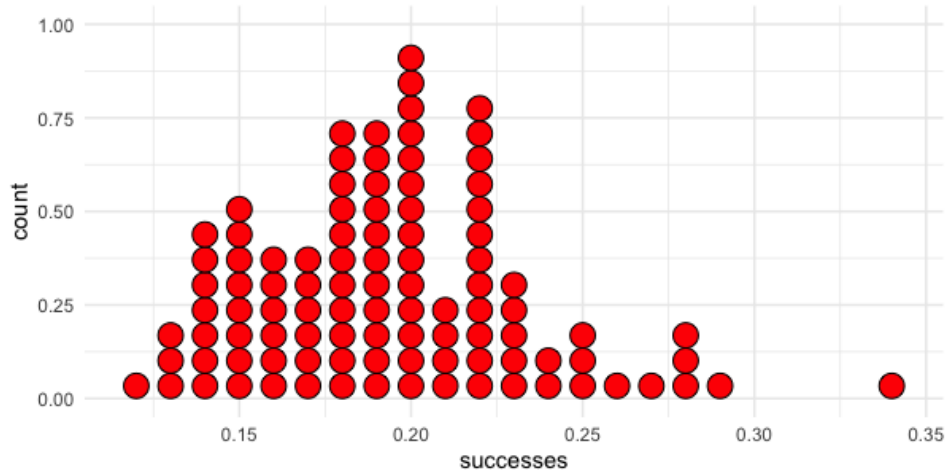
5. For our experiment we will be tasting and guessing the colour for 100 skittles. Using a random number generator simulate one hundred iterations of the experiment, tally correct guesses and calculate the proportion of trials that resulted in correct guesses.

Solution: Answers will vary between groups.

6. **As a class** conduct the skittle tasting experiment. Have 100 blind taste tests for a skittle. tally correct guesses and calculate the proportion of trials that resulted in correct guesses.

Solution: Answers will vary. In class we got a proportion of $\hat{p} = \frac{62}{100}$.

Later in this course we will discuss how to run this simulation using a computer (rather than generating 100 numbers). Mr. Merrick simulated this particular experiment 100 times, the result is shown in graph below



7. If an individual cannot taste the rainbow, what is the probability that we observe the proportion of correct guesses we saw as a class?

Solution: Answers will vary based on experiment outcome. There are no simulations that result in a more extreme observation than 0.62, so the probability is 0.

8. Is the probability you calculated in the previous problem evidence against the null hypothesis?

Solution: This is very strong evidence against the null hypothesis.