Final Project

CEM LAB

ColorfulCrunch Choice Challenge:
Unveiling the Preferred Palette of Sunflower Seed Connoisseurs

Present to
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Background

In a bustling town marketplace, two stalls stand side by side, each a beacon of color and charm. They're not just any stalls; they're the talk of the town for their sunflower seeds, but for a curious reason: the colors of their bags.

The Red Stall: This stall is a splash of vibrancy, draped in shades of red from top to bottom. It's where fun meets flavor. The red bags of sunflower seeds here are said to be more than just snacks; they're little bundles of joy and energy. People say eating seeds from the red bag feels like a lively party in your mouth.

The Black Stall: Right next door, elegance reigns. Everything at this stall whispers sophistication, with black bags of sunflower seeds that promise a taste of luxury. Choosing a black bag is like choosing a ticket to an exclusive event, a snack that's both classy and classic.

Every day, customers flock to these stalls, drawn by the allure of red's excitement and black's elegance. But which color truly captures the heart of sunflower seed lovers? Is it the playful charm of red or the refined grace of black?

This tale of two colors isn't just a story; it's a question waiting to be answered through your poll. And as you look at the image of this whimsical marketplace scene, imagine the possibilities, the preferences, and the choices that make the simple act of picking a sunflower seed bag a journey into the world of color psychology.

The setup and assumptions

- **What are you testing for?**

We aimed to test which color package of sunflower seeds the normal people would prefer to buy: red or black. Participants will be divided into two equal groups, with one group exposed to the red sunflower seed package and the other to the black sunflower seed package. They will be asked to answer the question: Would you buy packaged sunflower seeds in that color? (YES/NO question).

- **Hypothesis**

Null Hypothesis (H_0): The buy rate for the red and black sunflower seed packages was the same. ($p_{red} - p_{black} = 0$)

where p_{red} is buy rate of people who see the red package

p_{black} is buy rate of people who see the black package

Alternative Hypothesis (H_A): The buy rate for the red sunflower seed packages is more than the black one was the same. ($p_{red} - p_{black} > 0$)

where p_{red} is buy rate of people who see the red package

p_{black} is buy rate of people who see the black package

- **Explanation of assumptions**

- The data is Bernoulli distribution. However, with more than 30 samples, we are considering using normal distribution to represent them.
- The test is two sided since we are testing that those two packages have equivalent results.
- We are using MDE = 0.15, significance = 0.05, power = 0.8 which is conventional. The significance (indicates 5% of incorrectly rejecting the null hypothesis) doesn't need to be lowered and the power (indicates 80% of correctly rejecting the null hypothesis) doesn't need to be greater since the result of the test doesn't have high risk.

Sample size calculation

From the formula,

$$n = 2\left(\frac{(Z_\alpha + Z_\beta)\sigma}{MDE}\right)^2 \quad , \quad \sigma^2 = p(1-p)$$

We use this formula because the poll is a Bernoulli trial (either black or red). We use p = 0.50

Then, we get σ

$\sigma^2 = 0.5 \times 0.5 = 0.25$

Finally, we calculate from the constants mentioned above,

$$n = 2\left(\frac{(1.6445 + 0.8416)}{0.15}\right)^2 * 0.25 \approx 137.35$$

What our form looks like

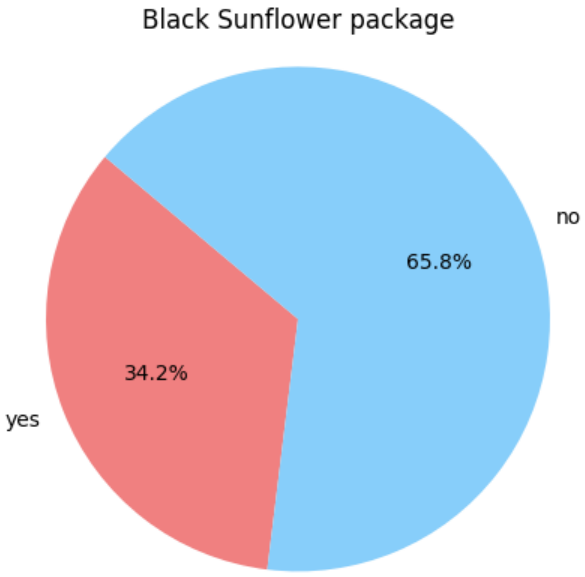
Our form will automatically change depending on the number of responses received, ensuring that each group has an equal number of responses.

For people who will see **red** package For people who will see **black** package

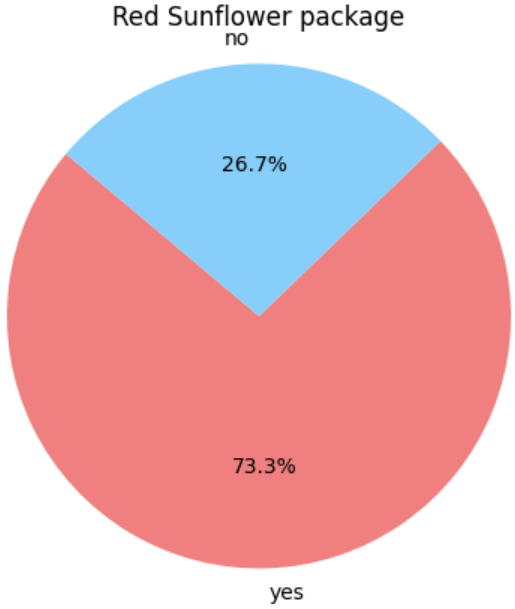
Our form url: https://sunflower-package.vercel.app

Result / Raw Data

Poll Black Sunflower package:



Poll Red Sunflower package:



Conclusion from raw data

{"code":200,"message":"black - yes: 98\nred - no: 75\nred - yes: 208\nblack - no: 185"}

type	answer	count
black	no	185
black	yes	96
red	no	75
red	yes	206

Black & Yes: 98 , Black & No: 185 , Red & Yes: 208 , Red & No: 75

Link to result url: Summary of Results

Link to csv file: result_sum.csv result_raw.csv black.csv red.csv

Calculation and Conclusion

For the Black sample,

$$p_{black} = \frac{96}{281} = 0.34$$

For the Red sample,

$$p_{red} = \frac{206}{281} = 0.73$$

Calculate Pooled Sample Proportion

$$p_{pooled} = \frac{206+96}{281+281} = 0.537$$

Calculate Standard Error (SE)

$$SE = \sqrt{p_{pooled} * (1 - p_{pooled}) * (\frac{1}{n_{black}} + \frac{1}{n_{red}})}$$

$$SE = \sqrt{0.537 * (1 - 0.537) * (\frac{1}{281} + \frac{1}{281})}$$

SE = 0.046

Calculate Z-Statistic:

$$Z = \frac{p_{red} - p_{black}}{SE}$$

Z = 8.478

Conclusion:

Using a significance level of 0.05 and comparing the calculated Z-statistic (8.478) with the critical Z-value (1.645), we find that 8.478 > 1.645. Therefore, we reject the null hypothesis.

In summary, the analysis provides strong evidence that the buy rate for the red sunflower seed packages is significantly higher than the buy rate for the black ones ($p_{red} - p_{black} > 0$)