

Black Friday Analysis

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September 22, 2024

Question 1: One-Sided Upper-Bound 99% Confidence Interval

A company is interested in determining an upper-bound on the mean amount of money spent on Black Friday

Step-by-step Calculation:

The formula for a one-sided upper-bound confidence interval is given by:

$$\text{Upper Bound} = \bar{X} + z_{\{\alpha\}} \cdot \frac{s}{\sqrt{n}}$$

Where:

- \bar{X} = 9263.97 (sample mean)
- s = 5023.07 (sample standard deviation)
- n = 550,068 (sample size)
- $z_{\{\alpha\}}$ = 2.326 (z-critical value for 99% one-sided confidence interval)

Using this information, the upper bound of the confidence interval is calculated as:

```
```r
Given values
mean_purchase <- 9263.97
std_purchase <- 5023.07
n <- 550068
z_critical <- 2.326

Calculate upper bound
upper_bound <- mean_purchase + z_critical * (std_purchase / sqrt(n))
upper_bound
```

The upper-bound 99% confidence interval is **9279.72**.

### Interpretation:

With 99% confidence, the true mean amount of money spent on Black Friday is less than or equal to **9279.72**.

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## Question 2: Hypothesis Test for Mean Difference

We are testing whether the mean amount spent on Black Friday in 2017 is less than \$12,000, based on the sample data from 2017. The 2018 average was \$12,000, and we will conduct a one-sided hypothesis test at the 5% significance level.

### Hypotheses:

- Null Hypothesis:  $(H_0: \mu = 12000)$
- Alternative Hypothesis:  $(H_1: \mu < 12000)$

### Test Statistic:

The z-test statistic is calculated as:

$$z = \frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}}$$

Where:  $(\mu_0 = 12000)$  -  $(\bar{X} = 9263.97)$  -  $(s = 5023.07)$  -  $(n = 550068)$

```
Hypothesized mean
mu_0 <- 12000

Calculate the z-statistic
z_stat <- (mean_purchase - mu_0) / (std_purchase / sqrt(n))
z_stat
```

The calculated z-statistic is **-403.98**.

### Critical Value:

The critical z-value for a one-sided test at  $(\alpha = 0.05)$  is:

```
z_critical_value <- qnorm(0.05)
z_critical_value
```

The critical z-value is **-1.645**.

### Conclusion:

Since the calculated z-statistic is much less than the critical value, we **reject the null hypothesis**. Therefore, there is strong evidence to conclude that the mean amount spent in 2017 is less than \$12,000 at the 5% significance level.