**HW 9: Statistical Inference with  Last Name: Stark, Cameron .**

**Problem 1** Orlando airport has noticed that while the volume of flights to Orlando has remained about the same, the average ticket price has seemed to increase. Previously, the average ticket price was $351. Access the recent data that was collected from a random sample of ticket prices from GoogleSheets[[1]](#footnote-1) and download it into Excel.

* 1. What type of hypothesis test would we want to run?
  2. What is 0 in this problem?
  3. Write out the two formal hypotheses (i.e. with the correct notation)

The Null Hypothesis states that the mean of ticket prices is equal to the stated mean

The Alternative hypothesis states that the mean of ticket process is greater than the stated mean

* 1. Are the conditions for using the Central Limit Theorem satisfied (justify your answer)?

Random: The problem statement states that the sample is randomly collected

Population: n > 30, therefore population is large enough

* 1. What is the null distribution for the sample means?
  2. What are the values of and ?
  3. Write out the command you use to compute the p-value for the observed sample mean

t-score = 0.58

p-value = t.dist(0.58, 111, TRUE)

* 1. Compute the p-value using this command and give its value.

p-value = = 0.719

* 1. If you ran your hypothesis test at =0.1, what would be your STATISTICAL decision (i.e. reject the null or fail to reject the null). Explain how you made the decision

p-value >  .719 > .1, fail to reject null hypothesis

* 1. State your final conclusion (remember this is the statement where you use ordinary language)

At a Significance level of 10% we decided that there is not sufficient evidence to conclude that the average price of airline tickets is greater than $351

**Problem 2** The average reported weekly sales for the company Gillette has been about $1.5 million dollars per headquarter. Earlier this year, Gillette ran a socially conscious ad about “toxic masculinity”. Experts are not sure if the ad will affect Gillette’s quarterly sales or if the effect of such controversies are short lived and the ad will have no effect on Gillette’s quarterly returns. From a random sample of the weekly sales from 9 local Gillette, the plot of the 25 weekly sales appeared relatively symmetric with an average of $1.48 million and a standard deviation of $0.15 million.

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1. What type of hypothesis test would we want to run?
2. What is 0 in this problem?
3. Write out the two formal hypotheses (i.e. with the correct notation)

The Null Hypothesis states that the mean return is equal to previous expected mean

The Alternative Hypothesis states that mean return is less than the previous expected mean

1. Are the conditions for using the Central Limit Theorem satisfied (justify your answer)?

Random: Problem states that the sample is random

Population Size: n < 30, but problem statement states that the distribution is symmetric

1. What is the null distribution for the sample means?
2. What are the values of and ?
3. Write out the command you use to compute the p-value for the observed sample mean

t-score = -0.4

p-value = t.dist(-0.4, 8, TRUE)

1. Compute the p-value using this command and give its value.

p-value = .34

1. If you ran your hypothesis test at =0.1, what would be your STATISTICAL decision (i.e. reject the null or fail to reject the null). Explain how you made the decision

p-value > 0.34 > 0.1, fail to reject the null hypothesis

1. State your final conclusion (remember this is the statement where you use ordinary language)

At a significance level of 10%, we decide that there is not sufficient evidence to conclude that the average weekly sales is not less than $1.5 million

**Problem 3**

1. Compute the 95% confidence interval for the average ticket price in problem 1. Fill in the table with the values you need to compute the confidence interval

|  |  |
| --- | --- |
| CENTER = MU\_HAT |  |
| **mu hat** | **354** |
|  |  |
| MOE = (EST SD)\*(# EST SD) |  |
| sigma hat | 23 |
| n | 112 |
| **est sd of mu hat = sigma hat/sqrt(n)** | **2.173** |
| Confidence Level | .95 |
| **est # sd of mu hat = t.inv( (1+Confidence Level)/2, n-1)** | **1.982** |
| **MOE = (est sd of mu hat)\*(est # of sd of mu hat)** | **4.307** |
|  |  |
| CI = CENTER +/- MOE |  |
| Lower Endpoint = mu\_hat - MOE | 349.7 |
| Upper Endpoint = mu\_hat + MOE | 358.3 |

1. Write out the 95% confidence interval for the mean ticket price:

[349.7, 358.3]

1. If you had computed a 90% confidence, instead of a 95% confidence interval, what quantities in the above table would have changed?

The two values shaded in red would have changed, which would have caused the MOE to change, which would change the lower and upper endpoints

1. How would the confidence interval change if you had computed a 90% confidence, instead of a 95% confidence interval?

The Interval would get narrower with endpoints of [350.4, 357.6]

**Problem 4**

1. Compute the 99% confidence interval for the average weekly headquarter sales in problem 2. Fill in the table with the values you need to compute the confidence interval

|  |  |
| --- | --- |
| CENTER = MU\_HAT |  |
| **mu hat** | **1.48** |
|  |  |
| MOE = (EST SD)\*(# EST SD) |  |
| sigma hat | .15 |
| n | 9 |
| **est sd of mu hat = sigma hat/sqrt(n)** | **.05** |
| Confidence Level | .99 |
| **est # sd of mu hat = t.inv( (1+Confidence Level)/2, n-1)** | **3.3554** |
| **MOE = (est sd of mu hat)\*(est # of sd of mu hat)** | **.1678** |
|  |  |
| CI = CENTER +/- MOE |  |
| Lower Endpoint = mu\_hat - MOE | 1.3122 |
| Upper Endpoint = mu\_hat + MOE | 1.6478 |

1. Write out the 99% confidence interval for the mean weekly sales:

[1.3122 million, 1.6478 million]

1. If you had used a sample of 25 headquarters, instead of a 9, what quantities in the above table would have changed?

The MOE would have changed and the resulting endpoints

1. Aside from the fact that the sample mean changes, what is the main effect of increasing the sample size from 9 to 25?

The resulting MOE gets smaller which means the range is shortened meaning a more accurate answer

1. <https://docs.google.com/spreadsheets/d/1PHDDrcLXsez-V8gUaKDC9sKkxTKtObBn6NAWMTlcXwU/edit?usp=sharing> [↑](#footnote-ref-1)