Quantitative Investment Analysis Homework 2

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Question 1

We would like to determine if the typical amount spent per customer for lunch at a new restaurant in Istanbul is more than TL60.00. A sample of 45 customers over a ten-week period was randomly selected and the average amount spent was TL45.50. Assume that the standard deviation is known to be TL6.50. Using a 0.05 level of significance, can we conclude the typical amount spent per customer is more than TL60.00?

```r
null_value <- 60
sample_n <- 45
sample_mean <- 45.5
stdev <- 6.5
a <- 0.05
```

Answer

$$H_0 : \mu \leq 60$$
$$H_a : \mu > 60$$

```r
standard_error <- stdev / sqrt(sample_n)
rejection_point <- qt(a, sample_n - 1, lower.tail = FALSE)
test_statistic <- (sample_mean - null_value) / standard_error
```

$$\sigma_{\bar{X}} = 0.97$$
$$\text{Test Statistic} = -14.96$$
$$\text{Rejection Point} = 1.68$$

No we can't conclude an increase. Test statistic is less than the rejection point.

Question 2

Suppose an equity research analyst claims that the mean time to write a research report is at most 4 weeks. A sample of 14 analysts is randomly selected and it is found that the mean time taken by them to write a report was 2.5. Assume also that the standard deviation is known to be 0.6 weeks. Assuming the time to write a research report is normally distributed and using a 0.02 level of significance, would you conclude the analyst's claim is true?

```r
null_value <- 4
sample_n <- 14
sample_mean <- 2.5
stdev <- 0.6
a <- 0.02
```

Answer

$$H_0 : \mu > 4$$
$$H_a : \mu \leq 4$$

```r
standard_error <- stdev / sqrt(sample_n)
rejection_point <- qnorm(a)
test_statistic <- (sample_mean - null_value) / standard_error
```

$$\sigma_{\bar{X}} = 0.16$$
$$\text{Test Statistic} = -9.35$$
$$\text{Rejection Point} = -2.05$$

Yes we can conlude that the analyst's claim is true. Test statistic is less than the rejection point.

Question 3

According to a 2010 demographic report, the average Turkish. household spends TL40 per day. Suppose you recently took a random sample of 30 households in Yalova and the results revealed a mean of TL34.50. Suppose the standard deviation is known to be TL6.50. Using a 0.05 level of significance, can it be concluded that the average amount spent per day by Turkish households has decreased?

```r
null_value <- 40
sample_n <- 30
sample_mean <- 34.5
stdev <- 6.5
a <- 0.05
```

Answer

$$H_0 : \mu \geq 40$$
$$H_a : \mu < 40$$

```r
standard_error <- stdev / sqrt(sample_n)
rejection_point <- qt(a, df = sample_n - 1)
test_statistic <- (sample_mean - null_value) / standard_error
```

$$\sigma_{\bar{X}} = 1.19$$
$$\text{Test Statistic} = -4.63$$
$$\text{Rejection Point} = -1.7$$

Yes we can conclude that average spending has decreased. Test statistic is less than the rejection point.

Question 4

Historically, evening long-distance calls from a particular city have averaged 17.2 minutes per call. In a random sample of 35 calls, the sample mean time was 15.8 minutes. Assume the standard deviation is known to be 4 minutes. Using a 0.10 level of significance, is there sufficient evidence to conclude that the average evening long-distance call has decreased?

```r
null_value <- 17.2
sample_n <- 35
sample_mean <- 15.8
stdev <- 4
a <- 0.10
```

Answer

$$H_0 : \mu \geq 17.2$$
$$H_a : \mu < 17.2$$

```r
standard_error <- stdev / sqrt(sample_n)
rejection_point <- qt(a, df = sample_n - 1)
test_statistic <- (sample_mean - null_value) / standard_error
```

$$\sigma_{\bar{X}} = 0.68$$
$$\text{Test Statistic} = -2.07$$
$$\text{Rejection Point} = -1.31$$

There is enough evidence to conclude that long-distace call has decreased. Test statistic is less than the rejection point.

Question 5

Suppose a food production line operates with a mean filling weight of 15 kilograms per container. Since over- or under-filling can be dangerous, a quality control inspector samples 30 items to determine whether or not the filling weight has to be adjusted. The sample revealed a mean of 15.32 kilograms. From past data, the standard deviation is known to be 0.75 kilograms. Using a 0.05 level of significance, can it be concluded that the process is out of control (not equal to 15 kilograms)?

```
null_value <- 15
sample_n <- 30
sample_mean <- 15.32
stdev <- 0.75
a <- 0.05
```

Answer

$$H_0 : \mu = 15$$
$$H_a : \mu \neq 15$$

```
standard_error <- stdev / sqrt(sample_n)
rejection_point <- qt(a / 2, df = sample_n - 1, lower.tail = FALSE)
test_statistic <- (sample_mean - null_value) / standard_error
```

$$\sigma_{\bar{X}} = 0.14$$
$$\text{Test Statistic} = 2.34$$
$$\text{Rejection Point} = 2.05$$

We can conclude that process is out of control on the heavier side. Test statistic is higher than rejection point.