Stat 235

Lab 4

WOOSAREE, Arun

Lab EL12

TA: Jessa Marley

November 19, 2018

Arun Woosaree XXXXXXX

1

1 a)

Keeping other parameters constant, changing the confidence level yields the folowing:

Confidence Level	Margin of Error
0.90	0.300308
0.95	0.357839
0.99	0.470280

Table 1: My caption

As seen in Table 1 above, the Margin of Error increases as the Confidence Level is increased. This makes sense because............

1 b)

Confidence Level	Observed Fraction of Intervals That Failed to Cover the Hypothesized Population Mean
0.90	0.11
0.95	0.06
0.99	0.02

Table 2: My caption

Theoretically, the confidence level and the fraction of intervals that failed to cover the hypothesized mean should be add up to 1. Here, we see that the values are reasonable, adding up to 1.01 in all cases. Of course, a small difference is expected since we are using experimental data.

2

$$H_0 : \mu = 64 \quad vs. \quad H_A : \mu \neq 64$$

2 a)

Level of Significance	Number of Samples That Led to the Rejection of H_0	Observed Fraction of Samples
0.10	89	0.89
0.05	94	0.94
0.01	98	0.98

Table 3: My caption

As the level of significance increases, the number of samples also increases. This is because the margin of error also increases???????

2 b)

Write your null hypothesis. (SHould have a solid understanding of p-values for this)

Compare the outcome of the test at the 5% level of significance with the 95% confidence intervals that failed to cover the mean of 64 for each sample. Repeat the exercise with the 1% level of significance and the 99% confidence intervals. What do you conclude about the relationship between confidence intervals and two-sided tests?

90% confidence interval

what isn't this the same

95% confidence interval

what isn't this the same

99% confidence interval

what isn't this the same

3

Summary tables for Alloy 1 and 2, Calculate the Confidence intervals yourself.

3 a)

Alloy 1	
Mean	65.09
Standard Error	0.360980466
Median	64.6
Mode	63.8
Standard Deviation	1.977171438
Sample Variance	3.909206897
Kurtosis	0.042639157
Skewness	0.718164135
Range	8.2
Minimum	61.7
Maximum	69.9
Sum	1952.7
Count	30
Confidence Level(95.0%)	0.738287948

Table 4: My caption

Alloy 2	
Mean	65.27333333
Standard Error	0.167601973
Median	65
Mode	64.9
Standard Deviation	0.917993815
Sample Variance	0.842712644
Kurtosis	9.565960304
Skewness	2.914366915
Range	4.5
Minimum	64.5
Maximum	69
Sum	1958.2
Count	30
Confidence Level(95.0%)	0.342784524

Table 5: My caption

Paste the summary statistics into your report and rep ort the 95% confidence interval for each alloy. Use the summaries to compare the two alloys. Which of the two alloys has better strength qualities? Explain briefly.

Alloy 1 appears to have better strength qualities because it has a higher confidence level?

3 b)

According to the specifications, the mean strength of each alloy is required to exceed 64 ksi. Is there any indication that the mean strength of either alloy is below the required threshold value of 64 ksi? Refe r to the 95% confidence interval for each alloy to answer the question. Explain briefly.

can be summarized in a few sentences – keep it simple, does it exceed the threshold value?

Nah I don't think so

4

Do the data provide evidence that the mean strength of each alloy exceeds the threshold value of 64 ksi? Now you will answer the question by carrying out the appr opriate statistical tests.

4 a)

Carry out an appropriate test to check the above claim using the data for each alloy. In particular, state the null and alternative hypotheses in terms of the population parameters, obtain the value of the test statistic , specify the distribution of the test statistic under the null hypothesis, and obtain the p - value of the test. What do you conclude? Notice that as there is no appropriate feature in Data Analysis to carry out the test directly, so you will have to calc ulate the value of the test statistic and the corresponding p - value by entering appropriate formulas into Excel worksheet. Lab 3 Instructions may be useful in this part.

Show your work here. (This is where LaTeX shines)

$$H_0 : \mu \leq 64 \quad vs. \quad H_A : \mu > 64$$

$$t_0 = \frac{\bar{x} - \mu}{s/\sqrt{n}} = XX \sim t_{x,x}$$

$$p - value : XX$$

We reject H_0 because...

4 b)

What are the assumptions about the distribution of strength required to make t he tests in part (a) valid? Do the assumptions hold? Explain briefly. It is not required to verify the assumptions with Excel.

The assumptions to make the tests in part (a) valid are as follows:

1.

What assumptions must be true for a t-test? Is there a theorem we covered that related to our normal distribution?

The following assumptions must be true for a t-test:

1.

The Central Limit Theorem.............

5

In this part , you will compare the mean strength of ALLOY 1 and ALLOY 2 rods. Do the data provide any evidence of a diffe rence in the mean strengths of ALLOY 1 and ALLOY 2 rods?

5 a)

Answer the above question by carrying out the appropriate test in the Data Analysis menu. Before you choose an appropriate test, you might refer to the output in Question 3 to decide what test would be appropriate. In particular, state the null and alternative hypotheses in terms of the population parameters, obtain the value of the test statistic, specify the distribution of the test statistic under the null hypothesis, and obtain the p - value o f the test. What do you conclude?

$$H_0 : \mu \quad vs. \quad H_A : \mu$$

$$t_0 =$$

$$p - value : XX$$

Output: t-test output from Excel. For Hypotheses, is this one or 2 tailed? Choose the correct t-test.

5 b)

What are the assumptions about the distribution of strength required to make the tests in part (a) valid? Do the assumptions hold? Explain briefly. It is not required to verify the assumptions with Excel.

The assumptions to make the tests in part (a) valid are as follows:

1.

WHat are the assumptions for the t-test?

The following assumptions must be true for a t-test:

1.

The Central Limit Theorem.............

6

Th e thirty ALLOY 2 rods were subjected to a combination of high pressure and temperature. In this question , you will estimate the effect of the treatment on the mean strength of the rods.

6 a)

Do the data provide evidence that the treatment increased the mean s trength of the ALLOY 2 rods? Answer the question by carrying out an appropriate test in Excel. In particular, state the null and alternative hypotheses in terms of the population parameters, obtain the value of the test statistic, specify the distributio n of the test statistic under the null hypothesis, and obtain the p - value of the test. What do you conclude?

$$H_0 : \mu \quad vs. \quad H_A : \mu$$

$$t_0 =$$

$$p - value : XX$$

t-test output from excel. CHoose t-test carefully

6 b)

Use the Descriptive Statistics feature in the Data Analysis menu to obtain a 95% two - sided confidence interval for the mean change in strength o f ALLOY 2 rods after the treatment. First create a new variable , EFFECT , defined as the difference in strength between ALLOY 2 + TREATMENT rods and ALLOY 2 rods. Is the interval consistent with the test outcome in part (a)? Explain briefly.

paste summary statistics from excel

6 c)

What are the assumptions necessary to make the test in part (a) and confidence interval in part (b) valid? Do the assumptions hold? Explain briefly.

The assumptions to make the tests in part (a) valid are as follows:

1.

what are the assumptions for a t-test? Is there a theorem we touched on earlier that relates to the normal distribution?

The following assumptions must be true for a t-test:

1.

The Central Limit Theorem.............

6 d)

Is the effect of the treatment independent of the initial strength of the rods? In order to answer the question, obtain the plot of the variable EFFECT versus ALLOY 2 measurements. What do you conclude?

Output: Change in strength vs Scatter plot of Alloy 2 strength. Remember to put the response on the y-axis. All relationships have error, look at the middle data cloud to determine shape.

q6.png

Figure 1: My caption