

Stat 235

Lab 4

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Lab EL12

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**1****1.a**

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

Confidence Level	Margin of Error
0.90	0.300308
0.95	0.357839
0.99	0.470280

Table 1: My caption

How does the margin of error change as the confidence interval increases? Explain briefly. 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

Are the observed counts consistent with the values predicted by the theory? Explain briefly. looks like you got some learnin to do....

**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	XXXX	XXXX
0.05	XXXX	XXXX
0.01	XXXX	XXXX

Table 3: My caption

How does the number of samples change as the level of significance increases? Explain briefly.

## 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?

## 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

Alloy 2 + Treatment	
Mean	66.82333333
Standard Error	0.108350573
Median	66.75
Mode	66.9
Standard Deviation	0.593460531
Sample Variance	0.352195402
Kurtosis	7.169408133
Skewness	2.210176389
Range	3.1
Minimum	66
Maximum	69.1
Sum	2004.7
Count	30
Confidence Level(95.0%)	0.221601804

Table 6: My caption

Paste the summary statistics into your report and report 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.

### 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? Refer 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?

## 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 appropriate 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 calculate 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 L<sup>A</sup>T<sub>E</sub>X shines)

### 4.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.

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

## 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 difference 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 of the test. What do you conclude?

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.

What are the assumptions for the t-test?

## 6

The 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 strength 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 distribution of the test statistic under the null hypothesis, and obtain the p - value of the test. What do you conclude?

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 of 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.

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

### 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.