Video “L11OneSampleTesting” (7:18)

(0:00):

The first video explained the basics of hypothesis testing. This video shows how we will use MATLAB to do the work and how we will interpret the results. First we state the null hypothesis, this is a statement of how things are the same. Next we state the alternative hypothesis which is the statement of how things are different. Then we set the significance level or how sure we want our conclusions to be. Then we evaluate the test statistic using MATLAB or doing the statistical analysis. Finally we make a conclusion based of the specified level of significance or how we interpret the results. MATLAB has 3 functions to test the test statistic that enable our decision making. The first is a z test which addresses the question does mystery population have a specified population mean and standard deviation. The next one is the ttest which addresses the question does mystery population have a specified mean. This video explains this function. Finally, ttest2 function which addresses the question do 2 samples from populations have the same mean. This function compares 2 sets of values against each other.

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The results of this function in MATLAB come back in the form of 3 variables: [h,p,c]. H is either 0 or 1, 1 indicates we accept the alternative hypothesis because we disproved the null hypothesis and 0 indicates we do not have enough evidence to disprove the null hypothesis, but we cannot prove it either. P is the p-value, it is a single value and it is the probability of being wrong. If p is less than the significance level then h will be 1. Finally, c is the confidence interval it is 2 numbers that mark the boundaries of the significance level. Suppose we wanted to answer the question do morning science students have an average score of 85. First we state the null hypothesis which is the students DO have an average score of 85. Then we state the alternative hypothesis which is morning science students do not have an average score of 85. Remember these are statements of belief not questions. Also remember the alternative is a statement about differences. In MATLAB we execute the ttest function where morning grades is a test vector that contains the sample and 85 is the hypothesized mean.

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With our question about all morning science grades in mind, we sample 1000 students and find out that the values range from 60-100 with most around 85. You could take the mean of this sample and perhaps it would be 85. Does this prove that all morning science students grades average around 85? No, it simply means are sample does. For the unmeasurable population its unmeasurable because it is too large. We needs a ttest to evaluate this question. The way we test statistically is we use a ttest function in this form. This might result in these values, but how does this answer our question of do morning students score 85 on average? First you will start with h or which hypothesis to use. In the previous result h was equal to 0 which means there is not evidence to disprove the null hypothesis which means it might be true. The null hypothesis was morning science students do score 85 on average. Remember, there is not enough evidence to say that they do not score 85 on average but not enough to say they do either. H is based on the p-value and confidence interval which are explained next.

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In the result p was equal to .565 which is greater than MATLAB’s default of 0.05 or the 5% significance level so we cannot disprove the null hypothesis that morning science students do

score 85 on average. If we had picked the alternative hypothesis that morning science students do not score 85 on average we would have had a 56.5% chance of being wrong. We are only willing to risk being wrong at the 5% level so we believe that the null hypothesis might be correct. In our result, c was 2 numbers 84.61 and 85.21. This means that based on morningGrades, we expect that 95% of the samples that are drawn of the same size will have a mean between 84.61 and 85.21. 85 is of course within this range so we have not disprove the null hypothesis. Let's look at another distribution of morning grades again this would be a sample of 1000 of morning science grades in an attempt to draw conclusions about all morning science students. Notice the average is closer to 83 of this one particular sample. We would actually keep the same MATLAB function, but in this case it results in a different set of values and we will look at how does this answer the question do morning students score 85 on average.

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Now h is equal to 1 which means we accept the alternative hypothesis that morning science students do not score 85 on average. We find that there is enough evidence to say they do not have an average score of 85. In this result p is equal to 0.008 which is less than MATLAB's default 0.05 or 5% significance level. If we picked the alternative hypothesis students in morning do not score 85 on average there is a 0.8% chance of being wrong. Since we are willing to be wrong at any level less than the 5%, we accept the alternative hypothesis. Lastly for this scenario, c is equal to 82.75 and 83.40. This means that based on morningGrades, we except that 95% of the samples that are drawn of the same size will have a mean between 82.75 and 83.40. 85 is outside of this range so we pick the alternative hypothesis, we have disproved the null hypothesis. What would have happened if we had hypothesized that the sample mean has an average of 83? We would not have disproved the null hypothesis and the p value would have been greater than 0.05.