VIDEO: “Two sample testing in MATLAB” (5:58)

(00:00)
In the previous video we used a t-test function to test if a single population had a specified mean. This video explains how to use to t-test2 function to test if two samples come from populations with the same mean. For example, do morning science students have an average score different than the afternoon science students? So out null hypothesis will be- “Morning science students DO have the same average score as afternoon science students. And our alternatives hypothesis will be- “Morning science students DO NOT have the same average scores as afternoon science students. Notice that the alternative as always is a statement of how things are different. In MATLAB we execute the following command where morning grades and afternoon grade are vectors that contain the two test samples.

(00:52)
Now we have two samples one with the grades of the thousand morning science students and another with the grade of the thousand afternoon science students. These help us draw conclusions of two unmeasurable populations. Notice the means of the samples are closed to one another- does this statically proof the means of the populations are close? No, we need to use the t-test2 function. The function is in this form *video* and my results in these values. And we will explore how this answers the question, “Do morning students score the same as afternoon students on average?”

(01:36)
H was 0 in the results, so this means we do not have enough evidence which was that morning science students do have the same average as the afternoon science students. Remember, there is not enough evidence to say that they do not have the same average, but there is not also enough evidence to say they do. H is based on the P value in the confidence interval which we will explain next.

(02:02)
The p-value is equal to 0.702 which is greater than MATLAB’s default value which is 0.05 or the 5% significance level. Meaning that if we had picked the alternative hypothesis morning science students do not have the same average score as afternoon science students, we would have a 70.2% chance of being wrong. We only will risk being wrong at the 5% level, so we believe that the null hypothesis might be correct.

(02:36)
The confidence interval for this test ranges from -1.51 to 1.19. This means that based on the estimate of the differences of morning grades and afternoon grades we expect that 95% of the estimate of the differences will be between -1.51 and 1.19. This means that the population level of this mean of morning students is no smaller than 1.51 and the mean grade is 1.19 larger more than the afternoon grade. 0 is within this range and 0 represents no difference so we have no disputed the null hypothesis remember, we have no proofed it either.

(03:29)

Let’s look at another example. Again, two samples each with a thousand range one for morning and another for afternoon. Notice the sample means are further apart the function might now result in these values *video*. Now h=1 which mean that we accept the alternative hypothesis that morning science students do not have the same average science score as afternoon science students. There is enough evidence to proof that they do not have the same average score.

(4:06)
The p-value of this is 1.36 x 10^-7 in nonscientific notation we see many zeros. This number is less than MATLAB’s default value of 0.05 or the 5% significant level. So, if we pick the alternative hypothesis that morning science students do not have the same average score afternoon science students. We would have a very low percent change of being wrong. We are willing to be wrong at the 5% level, so we accept the alternative hypothesis.

(04:39)
And finally, for this example c is equal to 1.22 and 2.11 based on the estimates of the differences of the means of morningGrades and afternoonGrades, we expect that 95% of the estimates of the differences will be between 1.22 and 2.11. So now the mean of the morning population is 1.22 more than the mean of the afternoon population but not grader than 2.11 and more than the afternoon mean. 0 representing no difference is outside this range so we pick the alternative hypothesis and we have disproved the null hypothesis. Of course, we might want more detail on how average scores are different. For example, do morning science students have a better average than afternoon science students? The null hypothesis stays the same but the alternative hypothesis changes to morning science students have a high average score than afternoon science students. Outline more fully in the lesson the function used is a directional flag and the results ignore the differences on one side but since h is equal to one that means that we disprove the null hypothesis and accept that morning science students were higher on average than afternoon students.