Lecture 29 Worksheet

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Every worksheet will work as follows.

1. You will be entered into a Zoom breakout session with other students in the class.
2. Read through the worksheet, discussing any questions with the other participants in your breakout session.
   - You can call me using the "Ask for help" button.
   - Keep in mind that I will be going through all rooms during the session so it might take me a while to get to you.
3. Answer each question (preferably in the order provided) to the best of your knowledge.
4. While collaboration between students in a breakout session is highly encouraged and expected, each student has to submit their own version.
5. You will have 24 hours (see Compass) to submit your work.

Worksheet 1: Comparing variances

There is a number of applications where **consistency** is key. Hence, we want to devise a procedure that helps us identify if the variance of our (normally distributed) populations has changed. In this worksheet, you are asked to do exactly that.

In a Senior Design project at a manufacturing facility in Northern Kentucky, a team of engineering students has been asked to compare two different facility layouts. Raw material is picked up from the storage rooms; they are transported to the main floor for processing; they are then transported to packaging; after that a finalized product is sent out for shipping. Both facility layouts have led to *similar* average times from beginning of the process to the end. Additionally, both layouts appear to lead to normally distributed times. That said, the company is particularly interested in what the variances are; smaller variances are definitely prepared.

To investigate these two layouts the company has allowed the students to collect data on $n_1 = 9$ replications from layout 1 and $n_2 = 16$ replications from layout 2. The students calculated that the sample standard deviation was $s_1 = 14$ minutes and $s_2 = 8.5$ minutes. Answer the following questions.

Problem 1: Formulating the hypothesis

Formulate a suitable hypothesis to test whether the two layouts lead to different variances.

Answer to Problem 1.

H_0 :

H_1 :

Problem 2: Comparing variances

Using $\alpha = 5\%$, do you have enough evidence to deduce that the two layouts lead to different variances?

Answer to Problem 2.

Problem 3: Comparing variances revisited

What if we are interested in a one-sided hypothesis test? Using $\alpha = 5\%$, do you have enough evidence to deduce that the second layout leads to smaller variances? Remember that you will need to formulate a different hypothesis than the one in Problem 1.

Answer to Problem 3.

Worksheet 2: Comparing proportions

In a previous worksheet [1], we had discussed how environmentally conscious residents of different cities viewed themselves to be. Specifically, we had focused on the responses of two cities in the United States: one in the East and one in the West coast. Let us start from the one in the West: out of $n = 91$ respondents in Portland, 61 answered that they viewed themselves to be environmentally conscious. In Philadelphia, on the other hand, $n = 100$ respondents gave us 45 of them that stated they were environmentally conscious.

[1] See Worksheet 21.

Problem 4: Comparing proportions

Using $\alpha = 5\%$, can we claim that the two city resident populations both consider themselves equally environmentally conscious?

Answer to Problem 4.

Problem 5: Comparing proportions revisited

Using $\alpha = 5\%$, can we claim that the residents of Portland view themselves more environmentally conscious by 10 percentage points or more?

Answer to Problem 5.

Problem 6: Maximum α

What is the maximum value for α such that you would reject the hypothesis of Problem 5?

Answer to Problem 6.

Worksheet 3: A "full" test

Let us go back to the hypothesis tests of means and variances for two normally distributed populations. One class is trying a new tool for educational purposes. The students with access to the new tool are $n_1 = 8$ and have received final scores of (in decreasing order):

$$95, 93, 89, 89, 85, 80, 75, 67.$$

The students without access to the new tool are $n_2 = 6$ and have received final scores of:

$$83, 80, 80, 79, 77, 77.$$

Using $\alpha = 1\%, 5\%, 10\%$ perform suitable hypothesis tests to address the following two statements:

1. The new tool helps students do better in class.
2. The new tool amplifies discrepancies between students' access to technologies. This is shown in the variance of the students who got access to the tool (i.e., the variance seems to be higher).

Formulate suitable hypothesis; use suitable statistics; and deduce we have evidence in favor of the statements or not.

Answer to Problem 7.

Answer to Problem 7.