Directions:

In this discussion, you will apply the statistical concepts and techniques covered in this week's reading about hypothesis testing for the difference between two population proportions. In the previous week's discussion, you studied a manufacturing process at a factory that produces ball bearings for automotive manufacturers. The factory wanted to estimate the average diameter of a particular type of ball bearing to ensure that it was being manufactured to the factory's specifications.

Recently, the factory began a new production line that is more efficient than the existing production line. However, the factory still needs ball bearings to meet the same specifications. To compare the accuracy of the new process against the existing process, the factory decides to take two random samples of ball bearings. The first sample is of 50 randomly selected ball bearings from the existing production line, and the second sample is of 50 randomly selected ball bearings produced from the new production line. For each sample, the diameters of the ball bearings were measured.

The two samples will be generated using Python's numpy module. These data sets will be unique to you, and therefore your answers will be unique as well. Run Step 1 in the Python script to generate your unique sample data.

Suppose that the factory claims that the proportion of ball bearings with diameter values less than 2.20 cm in the existing manufacturing process is the same as the proportion in the new process. At alpha=0.05, is there enough evidence that the two proportions are the same? Perform a hypothesis test for the difference between two population proportions to test this claim.

**In your initial post, address the following items:**

1. Define the null and alternative hypotheses in mathematical terms as well as in words.
2. Identify the level of significance.
3. Include the test statistic and the P-value. See Step 2 in the Python script. (Note that Python methods return two tailed P-values. You must report the correct P-value based on the alternative hypothesis.)
4. Provide a conclusion and interpretation of the test: Should the null hypothesis be rejected? Why or why not?

Response:   
The null hypothesis is that the proportion of ball bearings with diameter values less than 2.20 cm in the existing manufacturing process is the same as in the new process. Mathematically, this can be shown as H0: p1 - p2 = 0.

The alternative hypothesis is that the proportion of ball bearings with diameter values less than 2.20 cm in the existing manufacturing process differs from that in the new process. Mathematically, this can be shown as H1: p1 - p2 ≠ 0.

Using the level of significance for this test, alpha = 0.05.

Based on the test statistic and P-value, a conclusion can be made about whether to reject the null hypothesis. Suppose the P-value is less than the significance level (alpha = 0.05). In that case, there is enough evidence to reject the null hypothesis and conclude that the proportion of ball bearings with diameter values less than 2.20 cm in the existing manufacturing process differs from the proportion in the new process. On the other hand, suppose the P-value is more significant than the significance level. In that case, there is not enough evidence to reject the null hypothesis, and it should be concluded that the proportion of ball bearings with diameter values less than 2.20 cm in the existing manufacturing process is the same as the proportion in the new process.  
  
My Data:

Diameters data frame of the first sample (showing only the first five observations)

Diameters:

0 2.49

1 1.61

2 3.03

3 2.38

4 2.05

Diameters data frame of the second sample (showing only the first five observations)

Diameters:

0 3.41

1 1.77

2 2.75

3 2.80

4 2.19

test-statistic = -0.23

two tailed p-value = 0.8218

In this discussion, we will analyze data from a factory that produces ball bearings for automotive manufacturers. The factory has recently implemented a new production line that is more efficient than the existing one and wants to compare the accuracy of the two processes in terms of the average diameter of a particular ball bearing type. Therefore, the factory took two random samples of 50 ball bearings each, one from the existing production line and one from the new production line, and measured the diameters of all the ball bearings in each sample.

The null hypothesis, in this case, is that there is no difference in the proportion of ball bearings with diameter values less than 2.20 cm between the existing manufacturing process and the new process. Mathematically, this can be represented as H0: p1 - p2 = 0

Where p1 represents the proportion of ball bearings with diameter values less than 2.20 cm from the existing manufacturing process, and p2 represents the proportion of ball bearings with diameter values less than 2.20 cm from the new process. This hypothesis states that the ratio of ball bearings with diameter values less than 2.20 cm is the same for both the existing and new manufacturing processes.

The alternative hypothesis is that there is a difference in the proportion of ball bearings with diameter values less than 2.20 cm between the existing manufacturing process and the new process. Mathematically, this can be represented as H1: p1 - p2 ≠ 0

This hypothesis states that the proportion of ball bearings with diameter values less than 2.20 cm is not the same for both the existing and new manufacturing processes. Therefore, the level of significance for this hypothesis test is 0.05.

The test statistic for this hypothesis test is -0.23, and the two-tailed P-value is 0.8218. Since the P-value (0.8218) is greater than the significance level (0.05), we fail to reject the null hypothesis. This means there is not enough evidence to suggest that the proportion of ball bearings with diameter values less than 2.20 cm is different between the existing and new manufacturing processes.

In conclusion, based on the results of this hypothesis test, we can say that the factory's claim that the proportion of ball bearings with diameter values less than 2.20 cm is the same in the existing and new manufacturing processes is not disproven. However, it is important to note that this test only provides evidence against the claim, and we cannot prove that it is true. More data and further analysis would be necessary to confirm the claim.