The null hypothesis is that the population mean diameter of ball bearings is 2.30 cm (μ = 2.30 cm), while the alternative hypothesis is that it is greater than 2.30 cm (μ > 2.30 cm). In other words, the null hypothesis claims the average diameter is 2.30 cm, while the alternative hypothesis claims it is larger than that.

The 90% confidence interval, (2.39, 2.62), means that if we were to take multiple samples of ball bearings from the manufacturing process and construct a 90% confidence interval for each sample, we would expect the true population mean of the diameter of the ball bearings to fall within the interval (2.39, 2.62) for 90% of the samples.

Also, a 99% confidence interval of (2.33, 2.69) for the diameter of ball bearings means that if multiple samples are taken and a 99% confidence interval is constructed for each, the true population mean is expected to fall within (2.33, 2.69) for 99% of the samples.

The z-test statistic of 2.58 also indicates that the sample mean of 2.46 cm is 2.58 standard deviations away from the claimed population mean of 2.30 cm. This suggests that the sample mean is significantly different from the claimed population mean. Therefore, the hypothesis that the average of 2.30 is incorrect. We conclude that the evidence to suggest the average diameter ball bearings from the manufacturing process is greater than 2.30 cm.

Diameters data frame

diameters

0 1.95

1 2.63

2 2.20

3 2.32

4 2.76

5 1.77

6 2.92

7 3.27

8 2.76

9 1.84

10 2.44

11 2.16

12 2.43

13 2.37

14 2.45

15 3.23

16 2.05

17 3.06

18 2.42

19 1.58

20 2.17

21 3.18

22 3.15

23 2.43

24 3.15

25 2.57

26 3.05

27 1.78

28 2.97

29 2.67

30 1.23

31 2.44

32 2.99

33 2.58

34 2.65

35 2.00

36 2.75

37 1.98

38 2.40

39 3.02

40 0.75

41 3.08

42 2.53

43 2.88

44 3.14

45 3.28

46 2.32

47 3.18

48 1.50

49 2.95

90% confidence interval (unrounded) = (2.3912912846323326, 2.6239087153676675)

90% confidence interval (rounded) = ( 2.39 , 2.62 )

99% confidence interval (unrounded) = (2.325461363228155, 2.689738636771845)

99% confidence interval (rounded) = ( 2.33 , 2.69 )

z-test hypothesis test for population mean

test-statistic = 2.58

two tailed p-value = 0.0099

Use the link in the Jupyter Notebook activity to access your Python script. Once you have made your calculations, complete this discussion. The script will output answers to the questions given below. You must attach your Python script output as an HTML file and respond to the questions below.

In this discussion, you will apply the statistical concepts and techniques covered in this week's reading to calculate a confidence interval and perform hypothesis testing for a manufacturing process.

The manufacturing process at a factory produces ball bearings that are sold to automotive manufacturers. The factory wants to estimate the average diameter of a ball bearing that is in demand to ensure that it is manufactured within the specifications. Suppose they plan to collect a sample of 50 ball bearings and measure their diameters to construct a 90% and 99% confidence interval for the average diameter of ball bearings produced from this manufacturing process.

The sample of size 50 was generated using Python's numpy module. This data set 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. Check to make sure your sample data is shown in your attachment.

In your initial post, address the following items. Be sure to answer the questions about both confidence intervals and hypothesis testing.

In the Python script, you calculated the sample data to construct a 90% and 99% confidence interval for the average diameter of ball bearings produced from this manufacturing process. These confidence intervals were created using the Normal distribution based on the assumption that the population standard deviation is known and the sample size is sufficiently large. Report these confidence intervals rounded to two decimal places. See Step 2 in the Python script.

Interpret both confidence intervals. Make sure to be detailed and precise in your interpretation.

It has been claimed from previous studies that the average diameter of ball bearings from this manufacturing process is 2.30 cm. Based on the sample of 50 that you collected, is there evidence to suggest that the average diameter is greater than 2.30 cm? Perform a hypothesis test for the population mean at alpha = 0.01.

In your initial post, address the following items:

Define the null and alternative hypothesis for this test in mathematical terms and in words.

Report the level of significance.

Include the test statistic and the P-value. See Step 3 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.)

Provide your conclusion and interpretation of the results. Should the null hypothesis be rejected? Why or why not?

In your follow-up posts to other students, review your peers' calculations and provide some analysis and interpretation:

How do their confidence intervals compare with yours?

If the population standard deviation is unknown and the sample size is not sufficiently large, would you still use the Normal distribution to calculate these confidence intervals, or would you choose another distribution? If the latter, which distribution would you choose?

Remember to attach your Python output and respond to all questions in your initial and follow-up posts. Be sure to clearly communicate your ideas using appropriate terminology. Finally, be sure to review the [Discussion Rubric](https://learn.snhu.edu/d2l/common/dialogs/quickLink/quickLink.d2l?ou=1230325&type=content&rcode=snhu-702316) to understand how you will be graded on this assignment.

How do their confidence intervals compare with yours?

90% confidence interval (unrounded) = (2.3912912846323326, 2.6239087153676675)

90% confidence interval (rounded) = (2.39 , 2.62 )

99% confidence interval (unrounded) = (2.325461363228155, 2.689738636771845)

99% confidence interval (rounded) = (2.33 , 2.69 )

If the population standard deviation is unknown and the sample size is not sufficiently large, would you still use the Normal distribution to calculate these confidence intervals, or would you choose another distribution? If the latter, which distribution would you choose?  
  
The T distribution is the best way forward for this. Due to the standard deviation being unknown and the simple size is not large.

The confidence interval at %90 is (2.42, 2.66). The confidence interval at %99 is (2.36, 2.72). The confidence interval at %90 would suggest that the mean lies between 2.42-2.66 and the interval at %99 lies between 2.36-2.72. Both intervals would suggest that the actual mean of the ball bearings is higher than that of the hypothesis

How do their confidence intervals compare with yours?  
90% confidence interval (rounded) = (2.39, 2.62) vs. (2.42, 2.66)

95% confidence interval (rounded) = (2.33, 2.69) vs. (2.36, 2.72)

Response 1: Our numbers are within 0.08 to 0.09 of each other both the 90% and 95% confidence levels. Very close compared to some students post and others commenting comparing their numbers, given that your numbers range is similar but a wider range then mine. I would also use a T distribution considering the giving population size is not known.

Response 2: Our numbers are not as similar as other students post, with both the 90% and 95% confidence intervals falling within a range of 0.08 to 0.09 of each other. This contrasts with other students' results, which have a wider range. Given that the population standard deviation is not known, and the sample size is not large, I would also choose to use the T distribution for this analysis.

Response 3: Our results differ from those of other students as our 90% and 99% confidence intervals have a relatively small range of difference, 0.08 to 0.09, when compared to a wider range in other students' results. Since the population standard deviation is unknown and the sample size is not large, it would be appropriate to use the T distribution for this analysis.

The null hypothesis suggests that the manufacturing company's ball bearings are produced with a mean diameter of 2.3cm. The alternative hypothesis suggests that the manufacturing company's mean diameter for ball bearings is larger than 2.3cm in diameter.

The level of significance is a = 0.01

The test statistic is z = 3.28 and p = 0.001

 The null hypothesis should be rejected. Looking at the confidence intervals first would suggest that the null hypothesis should be rejected as they are generally higher than the original measurement. This is reinforced by the p value being smaller than the significance level.

How do their confidence intervals compare with yours?

If the population standard deviation is unknown and the sample size is not sufficiently large, would you still use the Normal distribution to calculate these confidence intervals, or would you choose another distribution? If the latter, which distribution would you choose?