[PRINT]

STAT2040DE_S20,
6/23/20 at 6:52:09 PM EDT

Question1: *Score 1/1*

Test the null hypothesis $H_0: \mu = 3.2$ against the alternative hypothesis $H_A: \mu \neq 3.2$, based on a random sample of 37 observations drawn from a normally distributed population with $\bar{x} = 3.4$ and $\sigma = 0.89$.

a) What is the value of the test statistic?

Round your response to at least 3 decimal places.

Your response	Correct response
1.367	**1.366913±0.001**

Grade: 1/1.0

b) What is the appropriate p-value?

Round your response to at least 3 decimal places.

Your response	Correct response
0.172	**0.171653±0.01**

Grade: 1/1.0

c) Is the null hypothesis rejected at:

i) the 5% level of significance?

Your response	Correct response
No	**No**

Grade: 1/1.0

ii) the 10% level of significance?

Your response	Correct response
No	**No**

Grade: 1/1.0

Total grade: 1.0×1/4 + 1.0×1/4 + 1.0×1/4 + 1.0×1/4 = 25% + 25% + 25% + 25%
Feedback:

a) The *z* test statistic is given by the formula $z = \frac{\bar{x}-\mu_0}{\frac{\sigma}{\sqrt{n}}}$. Substituting in the appropriate values, we can calculate the test statistic to be Error parsing MathML: error on line 1 at column 382: error parsing attribute name.

b) The alternative hypothesis indicates that we are performing a two-sided test. Therefore, the p-value is found as $2 \cdot P(Z \geq \mid 1.366913 \mid)$. Using computer software, or approximating with a standard normal table, we can find $P(Z \geq \mid 1.366913 \mid) = 0.085826$, and therefore $p - value = 2 \cdot 0.085826 = 0.171653$.

c) i) Since the p-value is larger than $\alpha = 0.05$, there is insufficient evidence to reject the null hypothesis at the 5% level of significance.

ii) Since the p-value is larger than $\alpha = 0.10$, there is insufficient evidence to reject the null hypothesis at the 5% level of significance.

Question2: *Score 1/1*

Test the null hypothesis $H_0 : \mu = 3.7$ against the alternative hypothesis $H_A : \mu < 3.7$, based on a random sample of 25 observations drawn from a normally distributed population with $\bar{x} = 3.5$ and $\sigma = 0.68$.

a) What is the value of the test statistic?

Round your response to at least 3 decimal places.

Your response	Correct response
-1.471	**-1.470588±0.001**

Grade: 1/1.0

b) What is the appropriate p-value?

Round your response to at least 3 decimal places.

Your response	Correct response
0.071	**0.070701±0.01**

Grade: 1/1.0

c) Is the null hypothesis rejected at:

i) the 10% level of significance?

Your response	Correct response
Yes	**Yes**

Grade: 1/1.0

ii) the 5% level of significance?

Your response	Correct response
No	**No**

Grade: 1/1.0

Total grade: 1.0×1/4 + 1.0×1/4 + 1.0×1/4 + 1.0×1/4 = 25% + 25% + 25% + 25%

Feedback:

a) The test statistic can be calculated using the formula: $Z = \frac{(\bar{x} - \mu)}{\frac{\sigma}{\sqrt{n}}} = \frac{(3.5 - 3.7)}{\frac{0.68}{\sqrt{n}}} = -1.470588.$

b) Since the alternative hypothesis indicates that the test is a one-sided, lower tailed test, the p-value is calculated as the area under the standard normal curve to the *left* of the test statistic. Therefore,
$p - value = P(Z < -1.470588) = .707012531065959E\text{-}1.$

c) i) Since the p-value calculated in part (b) is less than $\alpha = 0.10$, the null hypothesis *is* rejected at the 10% level of significance.

ii) At the 5% level of significance, the p-value is greater than $\alpha = 0.05$, and therefore the null hypothesis is *not* rejected.

Question3: *Score 1/1*

Suppose a hypothesis test of $H_0 : \mu = \mu_0$ is being carried out against the one-sided alternative $H_A : \mu < \mu_0$ at $\alpha = 0.1151$. Assume that the population is normally distributed, and that σ is known.

What is the appropriate rejection region?

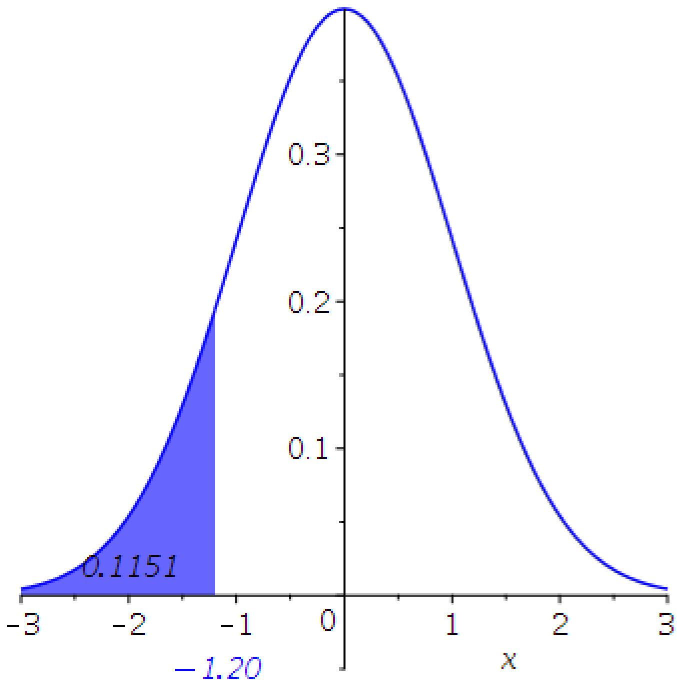
Your response	Correct response
$Z \leq -1.20$	$Z \leq -1.20$

Grade: 1/1.0

Total grade: 1.0×1/1 = 100%

Feedback:

Since the alternative hypothesis is a one-sided, lower tailed hypothesis, the critical value of ***z*** is one such that the area under the standard normal curve to the left of ***z*** must be 0.1151. Using a standard normal table, we can find this critical value to be -1.20.



Question4: *Score 1/1*

Suppose the null hypothesis of $H_0 : \mu = \mu_0$ is being tested against the one-sided alternative hypothesis $H_A : \mu < \mu_0$, at the 5% level of significance. If a random sample of size 6 is taken, and the population is assumed to be normally distributed, what is the appropriate rejection region?

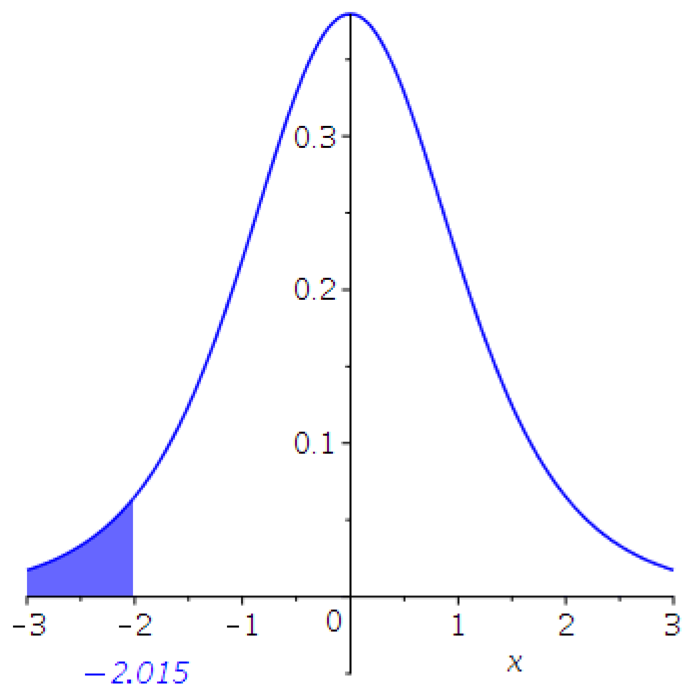
Your response	Correct response
$t \leq -2.015$	$t \leq -2.015$

Grade: 1/1.0

Total grade: 1.0×1/1 = 100%

Feedback:

For a one-sided, lower-tailed test, the rejection region is determined by the *t* value that has an area to the left, under a *t* distribution with 5 degrees of freedom, of 0.05. Using computer software or a *t* distribution table, we can find this value to be -2.015. Graphically, the rejection region is seen as:



Question5: *Score 0.33/1*

Suppose the null hypothesis of $H_0 : \mu = \mu_0$ is being tested against the two-sided alternative hypothesis $H_A : \mu \neq \mu_0$ in a population that is assumed to be normally distributed. If a random sample of size 28 is taken, and the *t* test statistic is calculated to be *t* = 2.171, then:

a) The p-value falls within which one of the following ranges:

Your response	Correct response
0.05 < p-value < 0.10	**0.02 < p-value < 0.05**

Grade: 0/1.0

b) Is the null hypothesis rejected at the 5% level of significance?

Your response	Correct response
No	**Yes**

Grade: 0/1.0

c) Is the null hypothesis rejected at the 1% level of significance?

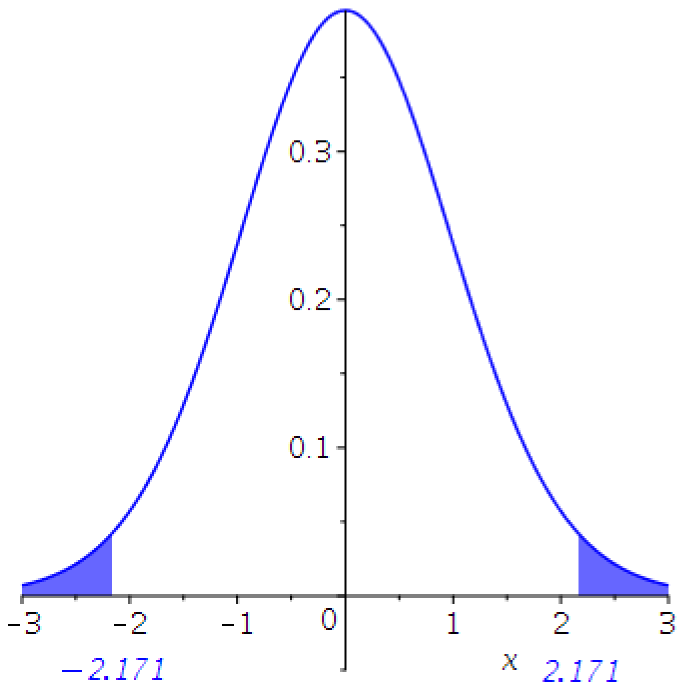
Your response	Correct response
No	**No**

Grade: 1/1.0

Total grade: 0.0×1/3 + 0.0×1/3 + 1.0×1/3 = 0% + 0% + 33%

Feedback:

a) The alternative hypothesis indicates a two-sided test, and therefore the p-value is given as $2 \cdot P(\ t\ > |\ 2.171\ |)$, where *t* follows a *t* distribution with 27 degrees of freedom. Graphically, this becomes:



Using computer software or a *t* distribution table, the p-value is found to be *0.038891*.

b) Since the p-value = 0.038891 is less than $\alpha = 0.05$, there is sufficient evidence to reject the null hypothesis at the 5% level of significance.

c) Since the p-value =0.038891 is greater than $\alpha = 0.01$, there is insufficient evidence to reject the null hypothesis at the 5% level of significance.

Question6: *Score 1/1*

Suppose the null hypothesis of $H_0 :\ \mu\ =\ \mu_0$ is being tested against a two-sided alternative hypothesis, at the 10% level of significance. If a random sample of size 25 is taken, and the population is assumed to be normally distributed, what is the appropriate rejection region?

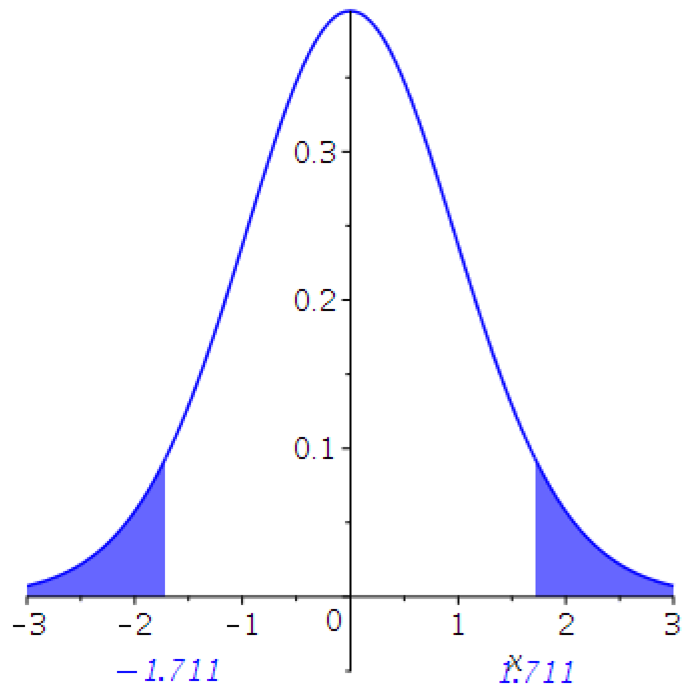
Your response	Correct response
$\lvert\ t\ \rvert\ \geq\ 1.711$	$\lvert\ t\ \rvert\ \geq\ 1.711$

Grade: 1/1.0

Total grade: 1.0×1/1 = 100%

Feedback:

For a two-sided hypothesis test, the rejection region is determined by a value of *t* such that for a *t* distribution with 24 degrees of freedom, $P\left(|\ t\ |\ \geq\ T\right)\ =\ \frac{0.10}{2} = 0.05$. Using computer software, or approximating with a *t* distribution table, we can find the value of *T* to be 1.710882. Therefore, the rejection region is $|\ t\ |\ \geq\ 1.711$, which is represented graphically as:



Question7: *Score 1/1*

Suppose a random sample of size 21 is taken from a normally distributed population, and the sample mean and variance are calculated to be $\bar{x} = 5.29$ and $s^2 = 0.5$ respectively.
Use this information to test the null hypothesis $H_0 : \mu\ =\ 5$ versus the alternative hypothesis $H_A :\ \mu\ >\ 5$.

a) What is the value of the test statistic, for testing the null hypothesis that the population mean is equal to 5?

Round your response to at least 3 decimal places.

Your response	Correct response
1.879	**1.879415±0.001**

Grade: 1/1.0

b) The p-value falls within which one of the following ranges:

Your response	Correct response
0.025 < p-value < 0.05	**0.025 < p-value < 0.05**

Grade: 1/1.0

c) i) Is the null hypothesis rejected at the 5% level of significance?

Your response	Correct response
Yes	**Yes**

Grade: 1/1.0

ii) Is the null hypothesis rejected at the 1% level of significance?

Your response	Correct response
No	**No**

Grade: 1/1.0

Total grade: 1.0×1/4 + 1.0×1/4 + 1.0×1/4 + 1.0×1/4 = 25% + 25% + 25% + 25%

Feedback:

a) To calculate the *t* test statistic, we use the formula $t = \frac{(\bar{x}-\mu)}{\frac{s}{\sqrt{n}}}$. Substituting in the appropriate values, we get

$$t = \frac{(5.29 - 5)}{\frac{\sqrt{0.5}}{\sqrt{21}}} = 1.879415.$$

b) The alternative hypothesis indicates we are conducting a one-sided, upper-tailed test. Therefore, the p-value is the area to the right of the test statistic, under the *t* distribution with *21 - 1 =20*. Using computer software or a *t* distribution table, we can find the p-value to be *0.037419*.

c) i) The p-value = 0.037419 is less than $\alpha = 0.05$, therefore there is sufficient evidence to reject the null hypothesis at the 5% level of significance.

ii) The p-value = 0.037419 is greater than $\alpha = 0.01$, therefore there is insufficient evidence to reject the null hypothesis at the 1% level of significance.

Question8: *Score 1/1*

Suppose a hypothesis test of $H_0: \ \mu = \mu_0$ is being carried out against a two-sided alternative hypothesis at $\alpha = 0.1$. Assume that the population is normally distributed, and that σ is known.

What is the appropriate rejection region?

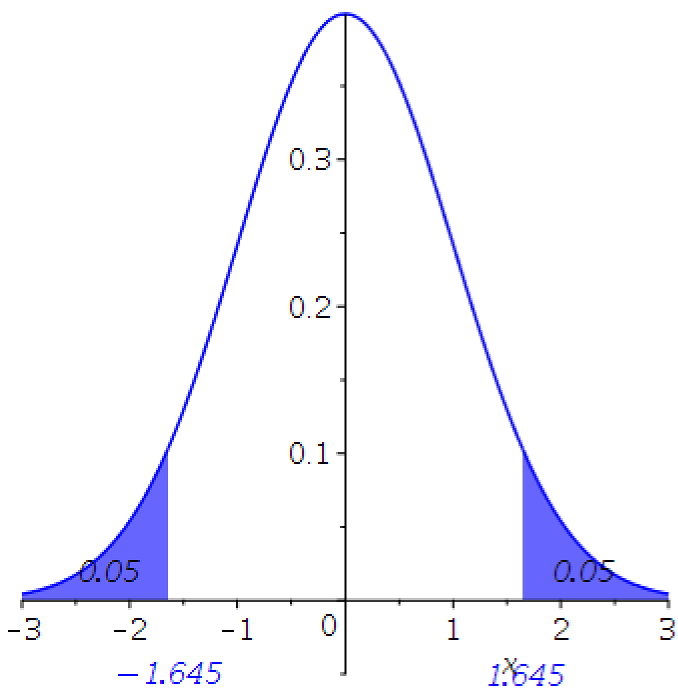
Your response	Correct response
$\lvert Z \rvert \geq 1.645$	$\lvert Z \rvert \geq 1.645$

Grade: 1/1.0

Total grade: 1.0×1/1 = 100%

Feedback:

Since the alternative hypothesis is two-sided, there are two rejection regions (one in the lower tail, one in the upper tail), with $\alpha = 0.1$divided equally between each region. The critical *z* value is then such that the area below -*z* and the area above *z* are each equal to 0.05. Using a standard normal table, we can find the critical *z* value to be 1.645.



Question9: *Score 1/1*

A local newscaster reports that the average rainfall in the month of June is approximately 91 mm. However, a meteorologist wishes to test this claim, believing that the average rainfall in June is actually higher than 91 mm. He collects data on the average June rainfall for 10 randomly selected years, and computes a mean of 93 mm. Assuming that the population standard deviation is known to be 20.0, and that rainfall is normally distributed, determine each of the following:

a) What are the appropriate hypotheses:

Your response	Correct response
$H_0 : \mu = 91,\ H_A : \mu > 91$	$H_0 : \mu = 91,\ H_A : \mu > 91$

Grade: 1/1.0

b) Calculate the appropriate test statistic.

Round your answer to at least 3 decimal places.

Your response	Correct response
0.316	**0.316228±0.001**

Grade: 1/1.0

c) What is the appropriate conclusion that can be made, at the 5% level of significance?

Your response	Correct response
There is insufficient evidence to reject the null hypothesis, and therefore no significant evidence that the mean rainfall in June is different from 91 mm.	**There is insufficient evidence to reject the null hypothesis, and therefore no significant evidence that the mean rainfall in June is different from 91 mm.**

Grade: 1/1.0

Total grade: 1.0×1/3 + 1.0×1/3 + 1.0×1/3 = 33% + 33% + 33%

Feedback:

a) Hypothesis testing is always carried out on the population parameter, which is this case is the population mean μ. The null hypothesis is what the current belief is; here, it is that the mean rainfall is 91 mm. The alternative hypothesis is the new idea that the researcher believes, which in this case is that the mean rainfall is actually greater than 91 mm. Therefore, the appropriate null and alternative hypotheses are $H_0 : \mu = 91, H_A : \mu > 91$.

b) To calculate the test statistic, we use the formula $Z = \frac{(\bar{x}-\mu_0)}{\frac{\sigma}{\sqrt{n}}}$. Substituting in the corresponding values, we get $Z = \frac{(93 - 91)}{\frac{20.0}{\sqrt{10}}} = 0.316228$.

c) To determine what conclusion can be made, we need to calculate the p-value for the test statistic calculated in part (b). Because the alternative hypothesis indicates that we are carrying out a one-sided, upper tailed test, the p-value is the area under the standard normal curve to the right of our calculated test statistic. Using computer software, or a standard normal table, we can find this area to be 0.375915. Comparing the p-value to $\alpha = 0.05$, we see that our p-value is greater than α, indicating that there is **insufficient evidence** to reject the null hypothesis.

Question10: *Score 1/1*

Suppose a hypothesis test of $H_0: \mu = \mu_0$ is tested against the alternative hypothesis $H_A: \mu < \mu_0$, and the resulting Z test statistic is $Z = 1.48$.

a) What is the appropriate p-value for the hypothesis test.

Round your response to at least 4 decimal places.

Your response	Correct response
0.9306	**0.930563±0.0001**

Grade: 1/1.0

b) Based on the p-value, would you reject the null hypothesis at the 10% level of significance?

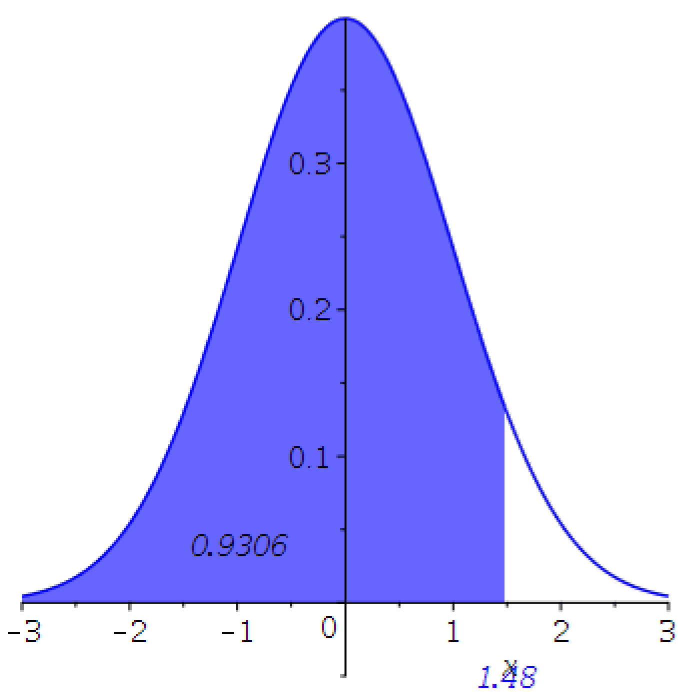
Your response	Correct response
No	**No**

Grade: 1/1.0

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

Feedback:

a) The alternative hypothesis indicates that we are performing a one-sided, lower tailed test. Therefore, the p-value is the area under the standard normal curve to the left of the test statistic. Using computer software, or approximating with a standard normal table, we can find this area to be *p-value = 0.930563*. Graphically, this is represented as:



b) Since the p-value is great than $\alpha = 0.10$, there is insufficient evidence to reject the null hypothesis, at the 10% level of significance.