

**QUESTIONS:**

1. You're performing a hypothesis test for the population mean critical t-value is 2.250, and you've got a 1-sided test. If your t-statistic is 2.200, what would your conclusion be?
  - Accept the null hypothesis and thus reject the alternative hypothesis
  - Fail to reject the null hypothesis
  - Fail to reject the alternative hypothesis
  - Reject the null hypothesis in favor of the alternative hypothesis
  
2. You're performing a hypothesis test for the population mean, and your sample mean is 10.5, your null hypothesis for the population mean is 11.5, your sample size is 30 and your population standard deviation is 2. Calculate your z test statistic:
  - 2.738
  - -2.738
  - -0.5
  - 0.5
  
3. You're performing a hypothesis test for the population mean, and your sample mean is 228, your null hypothesis for the population mean is 246, your sample size is 10 and your sample standard deviation is 16. Calculate your t test statistic:
  - 3.557
  - -3.557
  - -1.125
  - -1.800
  
4. You're performing a hypothesis test for the population mean, and your sample mean is 2.53, your null hypothesis for the population mean is 2.50, your sample size is 50 and your population standard deviation is 0.10. Calculate your z test statistic:
  - 0.300
  - 1.732
  - 2.121
  - 2.460
  
5. You're performing a hypothesis test for the population mean, and your sample mean is 10.82, your null hypothesis for the population mean is 10.83, your sample size is 4 and your sample standard deviation is 0.05. Calculate your t test statistic:
  - 0.300
  - -0.200
  - -0.300
  - -0.400

6. You're performing a hypothesis test for the population mean and you do not know the population standard deviation. You plan to sample 15 units from your population and you'd like to use a 1-sided test at a 10% significance level. What is the rejection criteria for this hypothesis test?
- 1.285
  - 1.341
  - 1.345
  - 1.650
7. You're performing a hypothesis test for the population mean and you know the population standard deviation. You plan to sample 45 units from your population and you'd like to use a 2-sided test at a 5% significance level. What is the rejection criteria for this hypothesis test?
- 1.345
  - 1.650
  - 1.761
  - 1.960
8. You're performing a hypothesis test for the population mean and you do not know the population standard deviation. You plan to sample 20 units from your population and you'd like to use a 2-sided test at a 5% significance level. What is the absolute value of the rejection criteria for this hypothesis test?
- 1.725
  - 1.960
  - 2.093
  - 2.086
9. What is the critical t-value for 2-sided confidence interval for the population mean where 20 samples have been taken and a 5% alpha risk is tolerable?
- 1.725
  - 1.960
  - 2.093
  - 2.086
10. You've sampled 50 units from the latest production lot to measure the outer diameter of the product. The sample mean is 0.51in and the population standard deviation is known to be 0.07in. Calculate the 95% confidence interval:
- 0.491 - 0.529
  - 0.487 - 0.532
  - 0.369 - 0.651
  - 0.507 - 0.513

11. You've sampled 20 units from the last production lot and found that 3 of them are non-conforming. Find the 95% confidence interval for the true population proportion of defective products.
- $0.070 < p < 0.229$
  - $0.000 < p < 0.306$
  - $-0.006 < p < 0.306$
  - $0.018 < p < 0.282$
12. You're performing a hypothesis test for the population mean and your critical z-score is 1.65, and you've got a 2-sided test. If your z-statistic is -1.71, what would your conclusion be?
- Accept the null hypothesis and thus reject the alternative hypothesis
  - Fail to reject the null hypothesis
  - Fail to reject the alternative hypothesis
  - Reject the null hypothesis in favor of the alternative hypothesis
13. You're performing a hypothesis test for the population mean, and your sample mean is 25.00 your null hypothesis for the population mean is 24.00. Your sample size is 20 and your sample standard deviation is 3.0. Calculate your t test statistic:
- 0.49
  - 1.49
  - 1.89
  - 2.39
14. You're performing a hypothesis test for the population mean and you do not know the population standard deviation. You plan to sample 20 units from your population and you'd like to use a 2-sided test at a 5% significance level. What is the rejection criteria for this hypothesis test?
- 1.725
  - 1.729
  - 2.086
  - 2.093
15. You're performing a hypothesis test for the population mean and your critical t-value is 2.093, and you've got a 2-sided test. If your t-statistic is 1.49, what would your conclusion be?
- Accept the null hypothesis and thus reject the alternative hypothesis
  - Fail to reject the null hypothesis
  - Fail to reject the alternative hypothesis
  - Reject the null hypothesis in favor of the alternative hypothesis

**SOLUTIONS:**

1. You're performing a hypothesis test for the population mean critical t-value is 2.250, and you've got a 1-sided test. If your t-statistic is 2.200, what would your conclusion be?

- Accept the null hypothesis and thus reject the alternative hypothesis
- **Fail to reject the null hypothesis**
- Fail to reject the alternative hypothesis
- Reject the null hypothesis in favor of the alternative hypothesis

In this instance, our t-statistic (2.200) is less than our critical t-value (rejection criteria) of 2.250. Therefore, we must **fail to reject the null hypothesis**.

2. You're performing a hypothesis test for the population mean, and your sample mean is 10.5, your null hypothesis for the population mean is 11.5, your sample size is 30 and your population standard deviation is 2. Calculate your z test statistic:

- 2.738
- **-2.738**
- -0.5
- 0.5

In this instance our hypothesis test sample size is greater than 30 and we know the population standard deviation; therefore, we can use the normal distribution and z-score for our test statistic.

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{10.5 - 11.5}{\frac{2}{\sqrt{30}}} = \mathbf{-2.738}$$

3. You're performing a hypothesis test for the population mean, and your sample mean is 228, your null hypothesis for the population mean is 246, your sample size is 10 and your sample standard deviation is 16. Calculate your t test statistic:

- 3.557
- **-3.557**
- -1.125
- -1.800

In this instance our hypothesis test sample size is less than 30 and we only know the sample standard deviation, not the population standard deviation; therefore, we must use the t-distribution and t-score for our test statistic.

$$t - \text{statistic} = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{228 - 246}{\frac{16}{\sqrt{10}}} = \mathbf{-3.557}$$

4. You're performing a hypothesis test for the population mean, and your sample mean is 2.53, your null hypothesis for the population mean is 2.50, your sample size is 50 and your population standard deviation is 0.10. Calculate your z test statistic:

- 0.300
- 1.732
- **2.121**
- 2.460

In this instance our hypothesis test sample size is greater than 30 and we know the population standard deviation; therefore we can use the normal distribution and z-score for our test statistic.

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{2.53 - 2.50}{\frac{0.10}{\sqrt{50}}} = \mathbf{2.121}$$

5. You're performing a hypothesis test for the population mean, and your sample mean is 10.82, your null hypothesis for the population mean is 10.83, your sample size is 4 and your sample standard deviation is 0.05. Calculate your t test statistic:

- 0.300
- -0.200
- -0.300
- **-0.400**

In this instance our hypothesis test sample size is less than 30 and we only know the sample standard deviation, not the population standard deviation; therefore, we must use the t-distribution and t-score for our test statistic.

$$t - \text{statistic} = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{10.82 - 10.83}{\frac{0.05}{\sqrt{4}}} = \mathbf{-0.400}$$

6. You're performing a hypothesis test for the population mean and you do not know the population standard deviation. You plan to sample 15 units from your population and you'd like to use a 1-sided test at a 10% significance level. What is the rejection criteria for this hypothesis test?

- 1.285
- 1.341
- **1.345**
- 1.650

Because you do not know the population standard deviation, you must use the **t-distribution**, and not the normal distribution for your hypothesis test.

Sampling 15 units means you've got **14 degrees of freedom** and therefore the rejection criteria of a 1-sided test at the 10% significance level is  $t_{\text{crit}} = \mathbf{1.345}$

df (v)	$\alpha = 0.1$	$\alpha = 0.05$	$\alpha = 0.025$	$\alpha = 0.01$	$\alpha = 0.005$	$\alpha = 0.001$
12	1.356	1.782	2.179	2.681	3.055	3.930
13	1.350	1.771	2.160	2.650	3.012	3.852
14	<b>1.345</b>	1.761	2.145	2.624	2.977	3.787
15	1.341	1.753	2.131	2.602	2.947	3.733

7. You're performing a hypothesis test for the population mean and you know the population standard deviation. You plan to sample 45 units from your population and you'd like to use a 2-sided test at a 5% significance level. What is the rejection criteria for this hypothesis test?

- 1.345
- 1.650
- 1.761
- **1.960**

Because we know the population standard deviation and we're sampling more than 30 units we can use the normal distribution for your hypothesis test. Based on the 2-sided test, and 5% significance level, we can look up the Z-value associated with 47.5% of the population, which is  $Z_{crit} = 1.960$

X	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1.5	0.43319	0.43448	0.43574	0.43699	0.43822	0.43943	0.44062	0.44179	0.44295	0.44408
1.6	0.44520	0.44630	0.44738	0.44845	0.44950	0.45053	0.45154	0.45254	0.45352	0.45449
1.7	0.45543	0.45637	0.45728	0.45818	0.45907	0.45994	0.46080	0.46164	0.46246	0.46327
1.8	0.46407	0.46485	0.46562	0.46638	0.46712	0.46784	0.46856	0.46926	0.46995	0.47062
1.9	0.47128	0.47193	0.47257	0.47320	0.47381	0.47441	<b>0.47500</b>	0.47558	0.47615	0.47670
2.0	0.47725	0.47778	0.47831	0.47882	0.47932	0.47982	0.48030	0.48077	0.48124	0.48169

8. You're performing a hypothesis test for the population mean and you do not know the population standard deviation. You plan to sample 20 units from your population and you'd like to use a 2-sided test at a 5% significance level. What is the absolute value of the rejection criteria for this hypothesis test?

- 1.725
- 1.960
- **2.093**
- 2.086

Because you do not know the population standard deviation, you must use the **t-distribution**, and not the normal distribution for your hypothesis test. Sampling 20 units means you've got **19 degrees of freedom** and therefore the rejection criteria of a 2-sided test at the 5% significance level is  $t_{crit} = 2.093$

df (v)	$\alpha = 0.1$	$\alpha = 0.05$	$\alpha = 0.025$	$\alpha = 0.01$	$\alpha = 0.005$	$\alpha = 0.001$
16	1.337	1.746	2.120	2.583	2.921	3.686
17	1.333	1.740	2.110	2.567	2.898	3.646
18	1.330	1.734	2.101	2.552	2.878	3.610
19	1.328	1.729	<b>2.093</b>	2.539	2.861	3.579
20	1.325	1.725	2.086	2.528	2.845	3.552

9. What is the critical t-value for 2-sided confidence interval for the population mean where 20 samples have been taken and a 5% alpha risk is tolerable?

- 1.725
- 1.960
- **2.093**
- 2.086

A sample size of 20 means that there are 19 degrees of freedom. With an alpha risk of 5% and a 2-sided confidence interval, we're looking for the intersection of the alpha risk of 0.025 and 19 degrees of freedom where we find our critical **t-value to be 2.093**.

df ( $\nu$ )	$\alpha = 0.1$	$\alpha = 0.05$	$\alpha = 0.025$	$\alpha = 0.01$	$\alpha = 0.005$	$\alpha = 0.001$
16	1.337	1.746	2.120	2.583	2.921	3.686
17	1.333	1.740	2.110	2.567	2.898	3.646
18	1.330	1.734	2.101	2.552	2.878	3.610
19	1.328	1.729	<b>2.093</b>	2.539	2.861	3.579
20	1.325	1.725	2.086	2.528	2.845	3.552

10. You've sampled 50 units from the latest production lot to measure the outer diameter of the product. The sample mean is 0.51in and the population standard deviation is known to be 0.07in. Calculate the 95% confidence interval:

- **0.491 - 0.529**
- 0.487 - 0.532
- 0.369 - 0.651
- 0.507 - 0.513

Because we've sampled more than 30 units and the population standard deviation is known, we can use the Z-score approach to this confidence interval problem. We need to find the Z-score associated with the 95% confidence interval using the Z-Table, we find  $Z = 1.96$ .

$$\text{Interval Estimate of Population Mean (known variance)} : \bar{x} \pm Z_{\frac{\alpha}{2}} * \frac{\sigma}{\sqrt{n}}$$

$$\text{Interval Estimate} : 0.51 \pm 1.96 * \frac{0.07}{\sqrt{50}}$$

$$\text{Interval Estimate} : 0.51 \pm 0.019$$

$$\text{95\% Confidence Interval} : 0.491 - 0.529$$

11. You've sampled 20 units from the last production lot and found that 3 of them are non-conforming. Find the 95% confidence interval for the true population proportion of defective products.

- $0.070 < p < 0.229$
- **$0.000 < p < 0.306$**
- $-0.006 < p < 0.306$
- $0.018 < p < 0.282$

First, we can calculate the sample proportion,  $p$  using  $n = 20$ , and the number of non-conformances (3):

$$\text{Sample Proportion: } p = \frac{3}{20} = 0.150$$

Then we can look up our Z-score at the 5% alpha risk:  $Z_{\frac{\alpha}{2}} = Z_{\frac{0.05}{2}} = Z_{0.025} = 1.96$

$$\text{Confidence Interval (Proportion): } p \pm Z_{\frac{\alpha}{2}} \sqrt{\frac{p * (1 - p)}{n}}$$

$$\text{Confidence Interval: } 0.150 \pm 1.96 \sqrt{\frac{0.150 * (1 - 0.150)}{20}}$$

$$\text{Confidence Interval: } 0.150 \pm 1.96 \sqrt{.0064}$$

$$\text{Confidence Interval: } 0.150 \pm 0.156$$

$$\text{Confidence Interval for Population Proportion : } 0.000 < p < 0.306$$

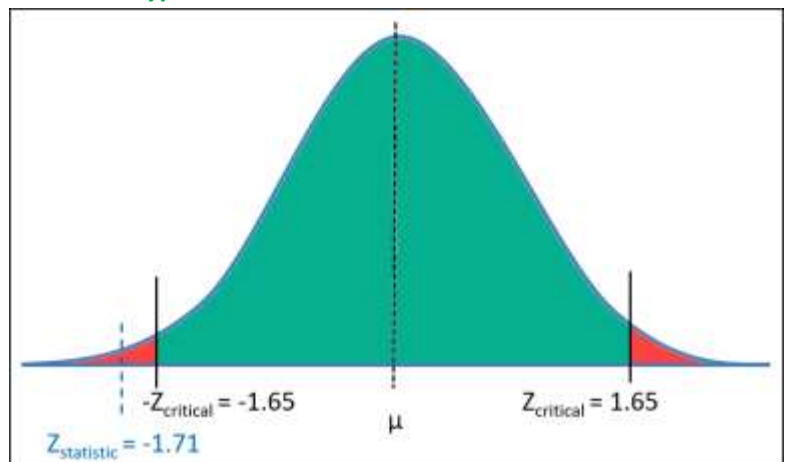
The negative value for the lower side of the confidence interval is adjusted to zero as it is impossible to have a negative proportion of defects.

12. You're performing a hypothesis test for the population mean and your critical z-score is 1.65, and you've got a 2-sided test. If your z-statistic is -1.71, what would your conclusion be?

- Accept the null hypothesis and thus reject the alternative hypothesis
- Fail to reject the null hypothesis
- Fail to reject the alternative hypothesis
- **Reject the null hypothesis in favor of the alternative hypothesis**

Because it is a 2-sided hypothesis test, you'll be looking for a value greater than 1.65, or less than -1.65.

Our value (-1.71) is less than -1.65, we can **reject the null hypothesis in favor of the alternative hypothesis.**





13. You're performing a hypothesis test for the population mean, and your sample mean is 25.00 your null hypothesis for the population mean is 24.00. Your sample size is 20 and your sample standard deviation is 3.0. Calculate your t test statistic:

- 0.49
- **1.49**
- 1.89
- 2.39

In this instance our hypothesis test sample size is less than 30 and we only know the sample standard deviation, not the population standard deviation; therefore, we must use the t-distribution and t-score for our test statistic.

$$t - \text{statistic} = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{25 - 24}{\frac{3.0}{\sqrt{20}}} = 1.49$$

14. You're performing a hypothesis test for the population mean and you do not know the population standard deviation. You plan to sample 20 units from your population and you'd like to use a 2-sided test at a 5% significance level. What is the rejection criteria for this hypothesis test?

- 1.725
- 1.729
- 2.086
- **2.093**

With an unknown population standard deviation, and only using 20 samples, we must use the t-distribution to create the critical rejection region for this hypothesis test.

With a 2-sided test, at 5% significance level, we must find the intersection between 19 degrees of freedom and an alpha risk of 0.025, where we find our critical t-value to be 2.093.

df ( $\nu$ )	$\alpha = 0.1$	$\alpha = 0.05$	$\alpha = 0.025$	$\alpha = 0.01$	$\alpha = 0.005$	$\alpha = 0.001$
12	1.356	1.782	2.179	2.681	3.055	3.930
13	1.350	1.771	2.160	2.650	3.012	3.852
14	1.345	1.761	2.145	2.624	2.977	3.787
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19	1.328	1.729	<b>2.093</b>	2.539	2.861	3.579
20	1.325	1.725	2.086	2.528	2.845	3.552

15. You're performing a hypothesis test for the population mean and your critical t-value is 2.093, and you've got a 2-sided test. If your t-statistic is 1.49, what would your conclusion be?

- Accept the null hypothesis and thus reject the alternative hypothesis
- **Fail to reject the null hypothesis**
- Fail to reject the alternative hypothesis
- Reject the null hypothesis in favor of the alternative hypothesis

Because our t-statistic (1.49) doesn't fall in the rejection region ( $> \pm 2.093$ ), we must **fail to reject the null hypothesis**.

