1. In hypothesis testing, the symbol $\alpha$ is typically used to denote...
   (a) the level of insignificance
   (b) the level of significance
   (c) the power of the test
   (d) the $p$-value of the evidence
   (e) the beginning of the end

2. In constructing a confidence interval for a population mean, increasing the sample size will tend to give ...
   (a) a larger margin of error
   (b) a wider confidence interval
   (c) a smaller margin of error
   (d) a smaller level of confidence
   (e) a larger critical value

3. In hypothesis testing, a Type I error occurs if . . .
   (a) the null hypothesis is rejected when the null hypothesis is actually true.
   (b) the null hypothesis is not rejected when the null hypothesis is false.
   (c) the level of significance is set at a very low value.
   (d) the sample size is too small.
   (e) the test statistic is close to 0.

4. In hypothesis testing, the maximum probability of a Type I error is called ...
   (a) the $p$-value.
   (b) the power of the test.
   (c) the level of significance.
   (d) the critical value.
   (e) the test hypotenuse.

5. In hypothesis testing, if the $p$-value is less than the level of significance,...
   (a) we have committed a Type I error.
   (b) there is not sufficient evidence to reject the null hypothesis.
   (c) we have committed a Type II error.
   (d) there is sufficient evidence to reject the null hypothesis.
   (e) the test has little power.

6. For a right tail hypothesis test of a population mean, the alternative hypothesis is ...
   (a) $\mu \neq \mu_0$
   (b) $\mu > \mu_0$
   (c) $\mu = \mu_0$
   (d) $\mu < \mu_0$
   (e) $\mu \geq \mu_0$
7. If a \((1 - \alpha)\) confidence interval for a population mean \(\mu\) contains the value 100, which of the following conclusions from a corresponding \textbf{two-tailed} hypothesis test (with significance level \(\alpha\)) is best?

(a) We have sufficient evidence to conclude that \(\mu \neq 100\).
(b) We have sufficient evidence to conclude that \(\mu > 100\).
(c) We have sufficient evidence to conclude that \(\mu < 100\).
(d) We have sufficient evidence to conclude that \(\mu = 100\).
(e) We do not have sufficient evidence to conclude that \(\mu \neq 100\).

8. The caffeine content, in milligrams (mg), was examined for a random sample of 100 cups of black coffee dispensed by a new machine. The claimed mean caffeine content for the new machine is 100, but the sample mean and standard deviation were 102 mg and 7.1 mg, respectively. Let \(\mu\) denote the true mean caffeine content for all cups of coffee dispensed by the new machine. Using level of significance \(\alpha = .05\) to test whether \(\mu\) exceeds 100, what are the \textbf{appropriate hypotheses} for the test?

(a) \(H_0 : \mu > 100\) vs. \(H_a : \mu \leq 100\)
(b) \(H_0 : \mu < 100\) vs. \(H_a : \mu > 100\)
(c) \(H_0 : \mu = 100\) vs. \(H_a : \mu \neq 100\)
(d) \(H_0 : \mu > 100\) vs. \(H_a : \mu = 100\)
(e) \(H_0 : \mu = 100\) vs. \(H_a : \mu > 100\)

9. The caffeine content, in milligrams (mg), was examined for a random sample of 100 cups of black coffee dispensed by a new machine. The claimed mean caffeine content for the new machine is 100, but the sample mean and standard deviation were 102 mg and 7.1 mg, respectively. Let \(\mu\) denote the true mean caffeine content for all cups of coffee dispensed by the new machine. What is the \textbf{value of the test statistic} for a large sample hypothesis test about \(\mu\)?

(a) .2817
(b) 1.645
(c) 2.817
(d) 0.0024
(e) .02817

10. The caffeine content, in milligrams (mg), was examined for a random sample of 100 cups of black coffee dispensed by a new machine. The claimed mean caffeine content for the new machine is 100, but the sample mean and standard deviation were 102 mg and 7.1 mg, respectively. Let \(\mu\) denote the true mean caffeine content for all cups of coffee dispensed by the new machine. Using level of significance \(\alpha = .05\), test whether \(\mu\) exceeds 100 and choose the best conclusion.

(a) We have sufficient statistical evidence (using \(\alpha = .05\)) to conclude that \(\mu > 100\).
(b) We have sufficient statistical evidence (using \(\alpha = .05\)) to conclude that \(\mu = 100\).
(c) We have sufficient statistical evidence (using \(\alpha = .05\)) to conclude that \(\mu \neq 100\).
(d) We have sufficient statistical evidence (using \(\alpha = .05\)) to conclude that \(\mu \geq 100\)
(e) We do not have sufficient evidence (using \(\alpha = .05\)) to conclude \(\mu > 100\).
11. A political candidate wants to estimate his chances of winning the coming election for mayor. Out of a random sample of 500 voters, 125 voters stated they supported the candidate. Find the 99% confidence interval for \( p \), the true proportion of supporters.

a. (.157, .343)  
b. (.179, .321)  
c. (.200, .300)  
d. (.228, .272)  
e. (.241, .259)

12. A political candidate claims that more than 20% of the voters support her. Using \( \alpha = .005 \), test her claim if in a random sample of 500 voters, 125 voters stated they supported the candidate. What are the appropriate hypotheses?

(a) \( H_0 : p = .20 \) vs. \( H_a : p > .20 \)  
(b) \( H_0 : p = .20 \) vs. \( H_a : p \neq .20 \)  
(c) \( H_0 : p > .20 \) vs. \( H_a : p \leq .20 \)  
(d) \( H_0 : p \geq .20 \) vs. \( H_a : p < .20 \)  
(e) \( H_0 : p < .20 \) vs. \( H_a : p > .20 \)

13. A political candidate claims that more than 20% of the voters support her. Using \( \alpha = .005 \), test her claim if in a random sample of 500 voters, 125 voters stated they supported the candidate. What is the value of the large-sample test statistic?

(a) 2.326  
(b) 2.576  
(c) 2.795  
(d) 3.017  
(e) 3.224

14. A political candidate claims that more than 20% of the voters support her. Using \( \alpha = .005 \), test her claim if in a random sample of 500 voters, 125 voters stated they supported the candidate. Find the \( p \)-value.

(a) .0427  
(b) .2713  
(c) .0352  
(d) .0026  
(e) .1819

15. A political candidate claims that more than 20% of the voters support her. Using \( \alpha = .005 \), test her claim if in a random sample of 500 voters, 125 voters stated they supported the candidate. Find the best conclusion.

(a) We have sufficient evidence to conclude that \( p = .20 \)  
(b) We do not have sufficient evidence to conclude that \( p = .20 \)  
(c) We have sufficient evidence to conclude that \( p > .20 \)  
(d) We do not have sufficient evidence to conclude that \( p > .20 \)  
(e) We have sufficient evidence to conclude that \( p \neq .20 \)
16. Heights of men aged 25 to 34 have a standard deviation of 2.9 inches. Use a 0.05 level of significance to test the claim that the heights of women aged 25 to 34 have a smaller standard deviation. Assume that the population of women heights has a normal distribution. The heights (in inches) of 16 randomly selected women aged 25 to 34 are listed below.

<table>
<thead>
<tr>
<th>Height (inches)</th>
<th>62.1</th>
<th>65.1</th>
<th>64.2</th>
<th>66.7</th>
<th>63.1</th>
<th>61.1</th>
<th>67.5</th>
<th>64.7</th>
</tr>
</thead>
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<td></td>
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<td>64.2</td>
<td>60.2</td>
<td>68.3</td>
<td>66.5</td>
<td>62.1</td>
<td>65.7</td>
<td>64.7</td>
</tr>
</tbody>
</table>

(i) Find the sample standard deviation.  
(ii) State the appropriate null and alternative hypotheses.

\[ H_0 : \mu = \mu_0 \]
\[ H_1 : \mu < \mu_0 \]

(iii) What is the value of the appropriate test statistic?  
(iv) Find the p-value for this test.  
(v) State the conclusion.

17. A company advertises that the median life of the widgets it produces is at least 5 months. A random sample of 10 widgets produced the following lifetimes (in months):

| Lifetime (months) | 1.3 | 4.7 | 5.8 | 2.9 | 4.2 | 5.1 | 4.8 | 4.9 | 4.4 | 4.5 |

(i) Replace each data value with a "+" or " - " according to whether the data value is above 5 or below 5. Let \( T \) equal the number of "+" 's. Find \( t \), the value for \( T \) in this problem.

(ii) If the company is correct in its statement, i.e., the median life of the population is 5 months, find the probability that a random sample of size 10 would produce as few (or fewer) "+"s as obtained above. In other words, find \( P(T \leq t) \) where \( T \) has a binomial distribution with \( n = 10 \) and \( p = .5 \).

(iii) In testing \( H_0 : \text{median} \geq 5 \) versus \( H_1 : \text{median} < 5 \) using \( \alpha = .05 \), what is the appropriate conclusion?