**1.** Which of the following are statistics?

- a. All of these choices.
- b. median
- c. mean
- d. standard deviation

- e. the population mean
- f. the population standard deviation
- g. the sample proportion
- h. the population proportion, $\pi$

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**2.** What is the distribution of the values of a statistic called?

- a. a sample
- b. a sampling distribution
- c. Central Limit Theorem
- d. a mean

**3** Which of the following defines the sampling distribution of $\bar{x}$?

- a. It is the distribution of the sample means for all samples of the same size from the population.
- b. It is the probability distribution of a population mean.
- c. It is the probability distribution of the sample proportion based on a random sample of size *n*.
- d. It is the probability distribution of the sample means for all possible sample sizes from the population.

**4** When can the Central Limit Theorem be safely applied using the conservative rule?

- a. When *n* is greater than 30

- b. When *n* is greater than or equal to 10
- c. When *n* is less than 10
- d. When *n* is greater than 20

5. Suppose a random sample of 15 snow throwers has a mean lifespan of 20 years. If it is known that $\sigma=4$, what is the test statistic for testing $H_0: \mu = 18$ versus $H_a: \mu < 18$?

- a. 0.026
- b. $z = -1.94$
- c. –0.50
- d. $t = 1.94$ with $df = 14$

6. What is the probability of a Type I error of a test $H_0: \pi = 0.62$ versus $H_a: \pi \neq 0.62$ of if a 0.05 level of significance is used for the test?

- a. 0.62
- b. 0.05
- c. The sample data is needed to determine the probability of a Type I error for a test.
- d. 0.10

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**7.** Suppose 15 students pass an exam in a class of size 25. If the population proportion of students who pass the exam is 0.65, what are the mean and standard deviation for the sampling distribution of *p*?

- a. $\mu_p = 0.65, \sigma_p = 0.095$
- b. $\mu_p = 0.05, \sigma_p = 0.0455$
- c. $\mu_p = 0.60, \sigma_p = 0.095$
- d. $\mu_p = 0.60, \sigma_p = 0.098$

8. When are two population means considered identical?

- a. when $\bar{x}_1 = \bar{x}_2$
- b. when $\sigma_1 = \sigma_2$
- c. when $\mu_1 = \mu_2$

- d. when $\mu_1 > \mu_2$

**9.** What is the test statistic for testing whether or not the true proportion of adults who visit a dentist regularly is indeed $\mu = 0.72$ or whether it is less? Suppose a random sample of 30 adults found that the proportion who visited a dentist regularly was $p = 0.67$.

- a. $z = 0.61$
- b. $z = -0.6099$
- c. $z = -0.5824$
- d. $z = 7.8044$

10 What is the *P*-value for a test of $H_0: \pi = 0.4$ versus $H_a: \pi \neq 0.4$ with a test statistic of $z = 1.8$?

- a. 1.928
- b. 0.9641
- c. 0.072
- d. 0.036

**11.** Which of the following is *not* true with regards to a *P*-value?

- a. A *P*-value indicates the strength of the evidence against the null hypothesis.
- b. A *P*-value does not tell us the probability that the null hypothesis is true.
- c. A *P*-value is a probability and must be between 0 and 1.
- d. The larger the *P*-value the more conclusive the evidence is against the null hypothesis.

12. If a computer is not available, what is a conservative estimate of the number of degrees of freedoms for the *t* curve when computing a two-sample confidence interval for the difference between two independent population means if $n_1 = 40$ and $n_2 = 20$?

- a. 60
- b. 19
- c. 39
- d. 20

13. The following *Minitab* output shows a comparison in yield for two types of wheat planted by Farmer Fred. What can you conclude from the information given?
Two-sample T for Yield

```
Field  N   Mean  StDev  SE Mean
1      6  2.940  0.303     0.12
2      6  2.960  0.373     0.15

Difference = mu (1) - mu (2)
Estimate for difference:  -0.020000
95% CI for difference:  (-0.463483, 0.423483)
T-Test of difference = 0 (vs not =): T-Value = -0.10  P-Value = 0.921  DF = 9
```

- a. There is no evidence to support a difference in the yield of the two types of wheat.
- b. The hypotheses being tested are $H_o: \mu_1 - \mu_2 = 0$ versus $H_a: \mu_1 - \mu_2 > 0$.
- c. The test statistic is $z = -0.10$.
- d. A 90% confidence interval for the difference in the mean yields is (–0.46, 0.42).

**1.** Fill in the blank. An unbiased statistic is a statistic whose mean value is ___________ the population characteristic estimated.

- a. equal to
- b. half the value of
- c. greater than
- d. less than

**.2** What is the confidence level associated with an interval for estimating $\pi$ that has the form $\left(p-1.96\sqrt{\frac{p(1-p)}{n}},\ p+1.96\sqrt{\frac{p(1-p)}{n}}\right)$?

- a. 5%
- b. 95%
- c. 90%
- d. 1.96

3. Consider the Minitab output given below. What is the value for the sample proportion used to compute the 95% confidence interval?

```
Sample    X    N  Sample p          95% CI
1        38   70   ???       (0.419421, 0.662552)
```

- a. 0.6625
- b. 0.542857
- c. 38
- d. 0.4194

4. What sample size should be used if we would like to estimate the mean age of the college students at a particular campus with 99% confidence? We would also like to be accurate within 3 years and we will assume the population is normally distributed with a standard deviation of 4.5 years.

- a. A sample size of at least 14 should be used.
- b. A sample size of at least 9 should be used.
- c. A sample size of at least 15 should be used.

- d. A sample size of at least 26 should be used.

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**5.** How are *t* distributions distinguished from one another?

- a. their standard deviation
- b. All *t* distributions are exactly the same.
- c. their mean
- d. their degrees of freedom

6. What is a point estimate for the population mean of GPA based on the Minitab output below from a random sample of data from the population?

```
One-Sample T: GPA
Variable    N     Mean    StDev  SE Mean        99% CI
GPA       200  2.63000  0.58033  0.04104  (2.52328, 2.73672)
```

- a. 2.63
- b. (2.52328, 2.73672)
- c. 0.58
- d. 200

**7.** Which of the following is the test statistic for a hypothesis of a population mean if the population standard deviation is unknown?

- a. $z = \dfrac{\bar{x} - \mu_{hypothesized}}{\frac{\sigma}{\sqrt{n}}}$
- b. $t = \dfrac{\bar{x} - \mu_{hypothesized}}{\frac{\sigma}{\sqrt{n}}}$, $df = n-2$
- c. $t = \dfrac{\bar{x} - \mu_{hypothesized}}{\frac{s}{\sqrt{n}}}$, $df = n-1$

- d. $z=\dfrac{p-\pi_{\text{hypothesized}}}{\sqrt{\dfrac{\pi_{\text{hypothesized}}(1-\pi_{\text{hypothesized}})}{n}}}$

8. Which of the following is the correct formula for constructing a confidence interval for $\mu$ when $\sigma$ is unknown and either the sample size is large or the population distribution is normal?

- a. $\bar{x}\pm(\text{t critical value})\dfrac{s}{\sqrt{n}}$
- b. $p\pm(\text{z critical value})\sqrt{\dfrac{p(1-p)}{n}}$
- c. $\bar{x}\pm(\text{z critical value})\dfrac{\sigma}{\sqrt{n}}$
- d. $\mu\pm(\text{z critical value})\dfrac{\sigma}{\sqrt{n}}$

**9.** Suppose the *P*-value equals 0.09 for testing whether grocery stores stocked on average more than 30 varieties of potato chips. Which of the following conclusions would be correct for testing the $H_0: \mu = 30 \text{ versus } H_a: \mu > 30$ hypotheses ?

- a. It can be concluded that stores stock more than 30 varieties on average using the $\alpha = 0.01$ significance level.
- b. It can be concluded that stores stock more than 30 varieties on average using the $\alpha = 0.05$ significance level.
- c. It can be concluded that on average stores do not stock more than 30 varieties using the $\alpha = 0.10$ significance level.
- d. It can be concluded that on average stores do not stock more than 30 varieties using the $\alpha = 0.05$ significance level.

10. Which of the following is the correct null hypothesis for testing whether two population means are the same?

- a. $H_0: \mu_1 - \mu_2 = 0$
- b. $H_0: \bar{x}_1 - \bar{x}_2 = 0$
- c. $H_0: \mu_1 - \mu_2 \neq 0$
- d. $H_0: \mu_1 - \mu_2 = 1$

11. If two independent random samples gave the following information, what would be the *t* value for testing that the population means are identical? Assume the populations are approximately normal.

Sample A: $n_A = 10, \bar{x}_A = 10, s_A = 5$ Sample B: $n_B = 20, \bar{x}_B = 12, s_B = 6$

- a. $t = 2.0$
- b. $t = -0.96$
- c. $t = 5.79$
- d. $t = -2.24$

12. What can be concluded from the following *Minitab* output in a study the heights of six randomly chosen first graders at the beginning of the school year (September) and the end of the school year (June)?

Paired T for height in June - height in September

```
                    N      Mean     StDev   SE Mean
height in June      6   45.2833    5.4609    2.2294
height in Septem    6   43.8333    5.4924    2.2423
Difference          6   1.45000   1.16404   0.47522

95% lower bound for mean difference: 0.49241
T-Test of mean difference = 0 (vs > 0): T-Value = 3.05  P-Value = 0.014
```

- a. Since the mean difference is 1.45 we can conclude that students grown on average 1.45 inches per year and thus there is a difference between mean heights of the students at the beginning of the school year and the mean height of students at the end of the school year at the $\alpha=0.01$level.
- b. The data support the theory that there is not a difference between mean heights of the students at the beginning of the school year and the mean height of students at the end of the school year at the $\alpha=0.05$level.
- c. The data support the theory that there is a difference between mean heights of the students at the beginning of the school year and the mean height of students at the end of the school year at the $\alpha=0.05$level.
- d. The data support the theory that there is a difference between mean heights of the students at the beginning of the school year and the mean height of students at the end of the school year at the $\alpha=0.01$level.

13. What is the formula $p_c = \dfrac{n_1p_1+n_2p_2}{n_1+n_2}$ used to compute?

- a. It is the test statistic for comparing two population proportions.
- b. It is the standard deviation used when constructing a confidence interval for $\pi_1 - \pi_2$.
- c. It is the pooled standard deviation for two proportions.
- d. It is the statistic for estimating the common population proportion when $\pi_1 = \pi_2$.