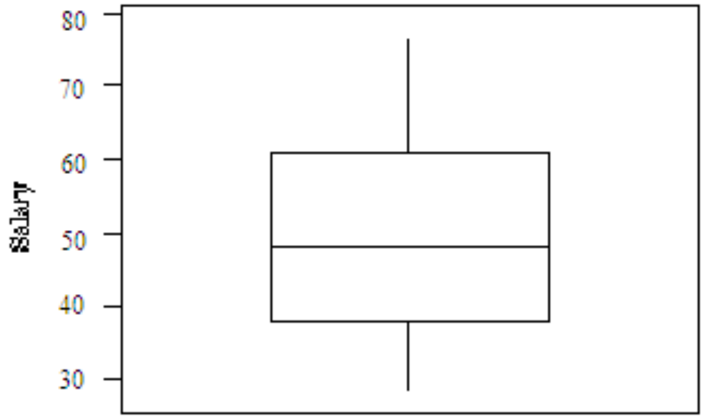
Practice Final (Multiple Choices)

1. A sample was taken of the salaries of 20 employees of a large company. The following is a boxplot of the salaries (in thousands of dollars) for this year.

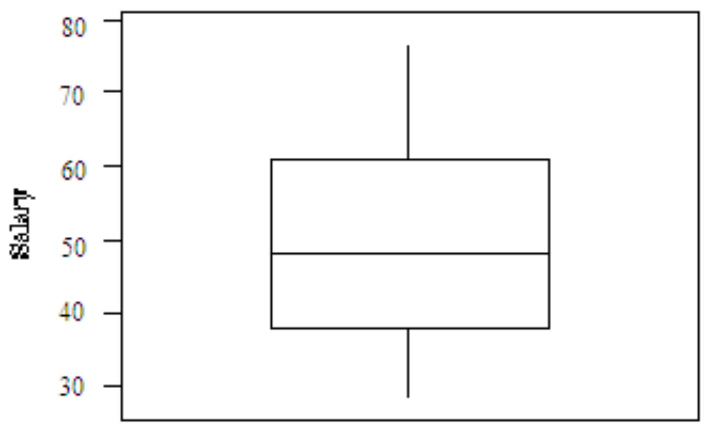


Reference: Ref 1-10

Based on this boxplot, which of the following statements is true?

- **A.** The maximum salary is between $60,000 and $70,000.
- **B.** The minimum salary is $20,000.
- **C.** The interquartile range is about $20,000.
- **D.** The median salary is about $40,000.

2. A sample was taken of the salaries of 20 employees of a large company. The following is a boxplot of the salaries (in thousands of dollars) for this year.



Reference: Ref 1-10

Based on this boxplot, which of the following statements is true?

- **A.** The salary distribution is fairly symmetric.
- **B.** About 10 employees make over $50,000.
- **C.** Nobody makes over $80,000.

D. All of the above.

3. A new brand of hybrid car claims to get an average of 51 miles per gallon of regular unleaded gasoline during stop and go driving. The distance the car travels on one gallon of fuel has a normal distribution with a standard deviation of 5.8 miles.

Reference: Ref 1-13

Approximately what percentage of these hybrid cars get over 60 miles per gallon?

- **A.** 43.94%.
- **B.** 1.55%.
- **C.** 93.94%.
- **D.** 6.06%.

4. A new brand of hybrid car claims to get an average of 51 miles per gallon of regular unleaded gasoline during stop and go driving. The distance the car travels on one gallon of fuel has a normal distribution with a standard deviation of 5.8 miles.

Reference: Ref 1-13

What is the approximate maximum number of miles per gallon that puts a driver in the bottom 5% of all drivers?

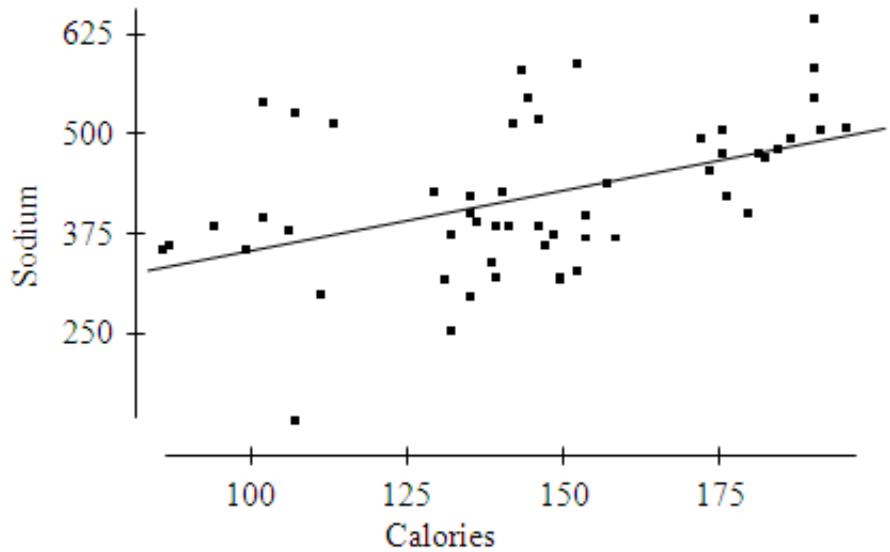
- **A.** 51 miles per gallon.
- **B.** 41.46 miles per gallon.
- **C.** 60.54 miles per gallon.
- **D.** 43.58 miles per gallon.

5. The graph below plots the gas mileage (miles per gallon, or MPG) of various 1978 model cars versus the weight of these cars in thousands of pounds.

The points denoted by the plotting symbol × correspond to cars made in Japan. From this plot, we may conclude that:

- **A.** there is little difference between Japanese cars and cars made in other countries.
- **B.** Japanese cars tend to be lighter in weight than other cars.
- **C.** Japanese cars tend to get poorer gas mileage than other cars.
- **D.** the plot is invalid. A scatterplot is used to represent quantitative variables, and the country that makes a car is a qualitative variable.

6. The following is a scatterplot of the calories and sodium content of several brands of meat hot dogs. The least-squares regression line has been drawn in on the plot.



Referring to the scatterplot above, based on the least-squares regression line one would predict that a hot dog containing 100 calories would have a sodium content of about:

- **A.** 70.
- **B.** 350.
- **C.** 400.
- **D.** 600.

7. In order to investigate whether women are more likely than men to prefer Democratic candidates, a political scientist selects a large sample of registered voters, both men and women. She asks every voter whether they voted for the Republican or the Democratic candidate in the last election. This is:

- **A.** an observational study.
- **B.** a multistage sample.
- **C.** a double blind experiment.
- **D.** a block design.

8. A public opinion poll in Virginia wants to determine whether registered voters in the state approve of a measure to ban smoking in all public areas. They select a simple random sample of 100 registered voters from each county in the state and ask whether they approve or disapprove of the measure. This is an example of:

- **A.** a convenience sample.
- **B.** a stratified sample.
- **C.** a multistage sample.
- **D.** a simple random sample.

9. In order to select a sample of undergraduate students in the United States, I select a simple random sample of four states. From each of these states, I select a simple random sample of two colleges or universities. Finally, from each of these eight colleges or universities, I select a simple random sample of 20 undergraduates. My final sample consists of 160 undergraduates. This is an example of:

- **A.** simple random sampling.
- **B.** stratified random sampling.

C. multistage sampling.

D. convenience sampling.

10. A marketing experiment compares two different types of packaging for a new granola bar. Each type of packaging can be presented in one of three different colors. Each combination of package type with a particular color is shown to 66 potential customers, who rate the overall attractiveness on a scale of 1 to 7.

Reference: Ref 3-11

The experimental units in this experiment are:

A. the potential customers.

B. the measure of attractiveness.

C. type of packaging and color.

D. the three different colors.

11. A marketing experiment compares two different types of packaging for a new granola bar. Each type of packaging can be presented in one of three different colors. Each combination of package type with a particular color is shown to 66 potential customers, who rate the overall attractiveness on a scale of 1 to 7.

Reference: Ref 3-11

The factors are:

A. the rating scale and package combination.

B. the three different colors.

C. the potential customers.

D. type of packaging and color.

12. A marketing experiment compares two different types of packaging for a new granola bar. Each type of packaging can be presented in one of three different colors. Each combination of package type with a particular color is shown to 66 potential customers, who rate the overall attractiveness on a scale of 1 to 7.

Reference: Ref 3-11

The number of treatments is:

A. 3.

B. 5.

C. 6.

D. 7.

13. A probability model must satisfy which of the following?

A. The probability of any event must be a number between 0 and 1, inclusive.

B. The sum of all the probabilities of all outcomes in the sample space must be exactly 1.

C. The probability of an event is the sum of the outcomes in the sample space that make up the event.

D. All of the above.

14. In a particular game, a fair die is tossed. If the number of spots showing is either 4 or 5 you win $1; if the number of spots showing is 6 you win $4; and if the number of spots showing is 1, 2, or 3, you win nothing. Let X be the amount that you win. The expected value of X is:

- A. $0.00.
- B. $1.00.
- C. $2.50.
- D. $4.00.

15. Professor Moore forgets to set his alarm with a probability of 0.10. If he sets the alarm, it will wake him on time to make his first class with a probability of 0.95. If he forgets to set the alarm, he wakes up in time for his first class with a probability of 0.25.

Reference: Ref 5-5

What is the probability that Professor Moore wakes up in time to make his first class tomorrow?

- A. 0.250.
- B. 0.855.
- C. 0.880.
- D. 0.950.

16. Professor Moore forgets to set his alarm with a probability of 0.10. If he sets the alarm, it will wake him on time to make his first class with a probability of 0.95. If he forgets to set the alarm, he wakes up in time for his first class with a probability of 0.25.

Reference: Ref 5-5

Professor Moore was late to his first class. What is the probability that Professor Moore set his alarm given this information?

- A. 0.045.
- B. 0.075.
- C. 0.375.
- D. 0.625.

17. A community college discovered that 18% of its students who enroll into an introductory statistics class withdraw. Assume 36 students have registered for an introductory statistics course this semester. What is the probability that four or fewer will withdraw?

- A. 0.1080
- B. 0.0906
- C. 0.1986
- D. 0.0596

18. A garment manufacturer knows that the number of flaws per square yard in a particular type of cloth that he purchases varies with an average of 1.3 flaws per square yard. The count X of flaws per square yard can be modeled by a Poisson distribution.

Reference: Ref 5-7

Using the Poisson probability formula, the probability of getting exactly two flaws in a randomly selected yard of cloth is:

- A. 0.2169.
- B. 0.3012.
- C. 0.3614.
- D. 0.6626.

19. A 90% confidence interval for the mean *m* of a population is computed from a random sample and is found to be 9 ± 3. Which of the following could be the 95% confidence interval based on the same data?

- **A.** 9 ± 2
- **B.** 9 ± 3
- **C.** 9 ± 4
- **D.** Without knowing the sample size, any of the above answers could be the 95% confidence interval.

20. You measure the weights of a random sample of 400 male workers in the automotive industry. The sample mean is $\bar{x}$ = 176.2 lbs. Suppose that the weights of male workers in the automotive industry follow a normal distribution with unknown mean μ and standard deviation σ = 11.1 lbs. I compute a 95% confidence interval for μ. Suppose I measure the weights of a random sample of 100 workers rather than 400. Which of the following statements is true?

- **A.** The margin of error for my 95% confidence interval would be larger than yours.
- **B.** The margin of error for my 95% confidence interval would be smaller than yours.
- **C.** The margin of error for my 95% confidence interval would be the same as yours because the level of confidence has not changed.
- **D.** σ would decrease.

21. A random sample of six CEOs reported how many times per year they play tennis. The data follows.

3 41 96 32 52 19

Assuming the number of games played is normally distributed and the population standard deviation σ = 10, a 95% confidence interval for μ is:

- **A.** (3, 96).
- **B.** (33.78, 44.22).
- **C.** (32.5, 48.5).
- **D.** (28.5, 44.5).

22. Other things being equal, the margin of error of a confidence interval increases as:

- **A.** the sample size increases.
- **B.** the confidence level decreases.
- **C.** the population standard deviation increases.
- **D.** none of the above.

23. In tests of significance about an unknown parameter, the test statistic:

- **A.** is the value of the unknown parameter under the null hypothesis.
- **B.** is the value of the unknown parameter under the alternative hypothesis.
- **C.** measures the compatibility between the null and alternative hypotheses.
- **D.** measures the compatibility between the null hypothesis and the data.

24. In a statistical test of hypotheses, we say the data are statistically significant at level α if:

- **A.** α = 0.05.
- **B.** α is small.

- **C.** the P-value is less than α.
- **D.** the P-value is larger than α.

25. The nicotine content in cigarettes of a certain brand is normally distributed, with mean (in milligrams) μ and standard deviation $\sigma = 0.1$. The brand advertises that the mean nicotine content of its cigarettes is 1.5, but measurements on a random sample of 100 cigarettes of this brand give a mean of $\bar{x} = 1.53$. Is this evidence that the mean nicotine content is actually higher than advertised? To answer this, test the hypotheses

H_0: $\mu = 1.5$, H_a: $\mu > 1.5$

at the 5% significance level. You conclude:

- **A.** that H_0 should be rejected.
- **B.** that H_0 should not be rejected.
- **C.** that H_a should be rejected.
- **D.** there is a 5% chance that the null hypothesis is true.

26. The power of a statistical test of hypotheses is:

- **A.** the smallest significance level at which the data will allow you to reject the null hypothesis.
- **B.** equal to 1 − (P-value).
- **C.** the extent to which the test will reject both one-sided and two-sided hypotheses.
- **D.** defined for a particular value of the parameter of interest under the alternative hypothesis and is the probability that a fixed level significance test will reject the null hypothesis when this particular alternative value of the parameter is true.

27. A medical researcher is working on a new treatment for a certain type of cancer. The average survival time after diagnosis on the standard treatment is two years. In an early trial, she tries the new treatment on three subjects, who have an average survival time after diagnosis of four years. Although the survival time has doubled, the results are not statistically significant even at the 0.10 significance level. Suppose, in fact, that the new treatment does increase the mean survival time in the population of all patients with this particular type of cancer. The researcher has:

- **A.** committed a type I error.
- **B.** committed a type II error.
- **C.** incorrectly used a level 0.10 test when she should have used a 0.05 level test.
- **D.** incorrectly used a level 0.10 test when she should have computed the P-value.

28. Given the following hypotheses, and the fact that $\sigma = 10$, $n = 25$, and the significance level is 10%,

H_0: $\mu = 100$, H_a: $\mu > 100$

the probability of committing a type II error when $\mu = 104$ is approximately:

- **A.** 0.0754.
- **B.** 0.9246.
- **C.** 0.1507.
- **D.** 0.8493.

29. Do students tend to improve their Math SAT scores the second time they take the test? A random sample of four students who took the test twice received the following scores.

Student	1	2	3	4
First score	450	520	720	600
Second score	460	570	750	640

Assume that the change in Math SAT score (second score – first score) for the population of all students taking the test twice is normally distributed with mean μ. A 95% confidence interval for μ is:

- **A.** (8.80, 56.20).
- **B.** (5.33, 59.67).
- **C.** (7.97, 57.03).
- **D.** (12.41, 52.59).

30. A food company is developing a new breakfast drink and their market analysts are currently working on preliminary taste-testing studies. To help with their marketing strategy, they were first interested in whether preference for the new product was related to a person's gender. There were 100 male and 100 female volunteers available for the taste test. Both the males and females tasted the product and rated the flavor on a scale of 1 to 10, 1 being "very unpleasant" and 10 being "very pleasant." The mean rating for males was $\bar{x}_1$ = 6.4, with a standard deviation s_1 = 1.5. The mean rating for females was $\bar{x}_2$ = 7.0, with a standard deviation s_2 = 2.0. Let μ_1 and μ_2 represent the mean ratings we would observe for the populations of males and females, respectively, and assume our samples can be regarded as samples from these populations.

Reference: Ref 7-6

A 90% confidence interval for $\mu_1 - \mu_2$ is (use the conservative value for the degrees of freedom):

- **A.** (−0.85, −0.35).
- **B.** (−0.92, −0.28).
- **C.** (−1.02, −0.18).
- **D.** (−1.10, −0.10).

31. A food company is developing a new breakfast drink and their market analysts are currently working on preliminary taste-testing studies. To help with their marketing strategy, they were first interested in whether preference for the new product was related to a person's gender. There were 100 male and 100 female volunteers available for the taste test. Both the males and females tasted the product and rated the flavor on a scale of 1 to 10, 1 being "very unpleasant" and 10 being "very pleasant." The mean rating for males was $\bar{x}_1$ = 6.4, with a standard deviation s_1 = 1.5. The mean rating for females was $\bar{x}_2$ = 7.0, with a standard deviation s_2 = 2.0. Let μ_1 and μ_2 represent the mean ratings we would observe for the populations of males and females, respectively, and assume our samples can be regarded as samples from these populations.

Reference: Ref 7-6

Suppose the researcher had wished to test the hypotheses

H_0: $\mu_1 = \mu_2$, H_a: $\mu_1 \neq \mu_2$.

The *P*-value for the test is (use the conservative value for the degrees of freedom):

- **A.** larger than 0.10.
- **B.** between 0.10 and 0.05.
- **C.** between 0.05 and 0.01.
- **D.** below 0.01.

32. The college newspaper of a large midwestern university periodically conducts a survey of students on campus to determine the attitude on campus concerning issues of interest. Pictures of the students interviewed along with a quote of their response are printed in the paper. Students are interviewed by a reporter "roaming" the campus who selects students to interview "haphazardly." On a particular day the reporter interviews eight students and asks them if they feel there is adequate student parking on campus. Five of the students say no.

Reference: Ref 8-1

The sample proportion $\hat{p}$ who respond "no" is:

- **A.** 0.375.
- **B.** 0.625.
- **C.** 0.667.
- **D.** 0.700.

33. The college newspaper of a large midwestern university periodically conducts a survey of students on campus to determine the attitude on campus concerning issues of interest. Pictures of the students interviewed along with a quote of their response are printed in the paper. Students are interviewed by a reporter "roaming" the campus who selects students to interview "haphazardly." On a particular day the reporter interviews eight students and asks them if they feel there is adequate student parking on campus. Five of the students say no.

Reference: Ref 8-1

Which of the following assumptions for inference about a proportion using a confidence interval are violated in this example?

- **A.** The data are an SRS from the population of interest.
- **B.** The population is at least 10 times as large as the sample.
- **C.** We are interested in inference about a proportion.
- **D.** There appear to be no violations.

34. In a large midwestern university (the class of entering freshmen being on the order of 6000 or more students), an SRS of 100 entering freshmen in 1993 found that 20 finished in the bottom third of their high school class. Admission standards at the university were tightened in 1995. In 1997 an SRS of 100 entering freshmen found that 10 finished in the bottom third of their high school class. Let p_1 and p_2 be the proportion of all entering freshmen in 1993 and 1997, respectively, who graduated in the bottom third of their high school class.

Reference: Ref 8-8

A 90% confidence interval for $p_1 - p_2$ is:

- **A.** 0.098 ± .050.
- **B.** 0.098 ± .083.
- **C.** 0.098 ± .099.
- **D.** 0.098 ± .130.

35. In a large midwestern university (the class of entering freshmen being on the order of 6000 or more students), an SRS of 100 entering freshmen in 1993 found that 20 finished in the bottom third of their high school class. Admission standards at the university were tightened in 1995. In 1997 an SRS of 100 entering freshmen found that 10 finished in the bottom third of their high school class. Let p_1 and p_2 be the proportion of all entering freshmen in 1993 and 1997, respectively, who graduated in the bottom third of their high school class.

Reference: Ref 8-8

Is there evidence that the proportion of freshmen who graduated in the bottom third of their high school class in 1997 has been reduced, as a result of the tougher admission standards adopted in 1995, compared to the proportion in 1993? To determine this, you test the hypotheses

H_0: $p_1 = p_2$, H_a: $p_1 > p_2$.

The *P*-value of your test is:

- **A.** between .10 and .05.
- **B.** between .05 and .01.
- **C.** between .01 and .001.
- **D.** below .001.