1. Fill in the blank to complete the statement below.

A _____ is a numerical measurement describing some characteristic of a population.

A (1) _____ is a numerical measurement describing some characteristic of a population.

(1)
- ○ sample
- ○ parameter
- ○ statistic
- ○ variable

2. Fill in the blank to complete the statement below.

A _____ is a numerical measurement describing some characteristic of a sample.

A (1) _____ is a numerical measurement describing some characteristic of a sample.

(1)
- ○ parameter
- ○ variable
- ○ statistic
- ○ sample

3. Fill in the blanks to complete the statement below.

Suppose that a researcher is interested in the average standardized test score for fifth graders in a local school district. The fifth graders at a specific school would comprise a _____ and their average test score would be a _____.

Suppose that a researcher is interested in the average standardized test score for fifth graders in a local school district. The fifth graders at a specific school would comprise a (1) _____ and their average test score would be a (2) _____

(1)
- ○ population
- ○ sample

(2)
- ○ parameter.
- ○ statistic.

4. Fill in the blank to complete the statement below.

A _____ variable counts or measures something and has numeric values.

A (1) _____ variable counts or measures something and has numeric values.

(1)
- ○ continuous
- ○ discrete
- ○ quantitative
- ○ qualitative

5. Can a qualitative variable have values that are numeric? Why or why not?

Choose the correct answer below.

- ○ **A.** No; by definition, qualitative variables must be categories or nonnumeric data.
- ○ **B.** No; numeric variables have values that can be added or subtracted in a meaningful way, making them quantitative rather than qualitative.
- ○ **C.** Yes; all qualitative variables are numeric.
- ○ **D.** Yes; it is possible to have numeric variables that do not count or measure anything, and, as a result, are qualitative rather than quantitative.

6. Explain why Social Security Number is considered a qualitative variable even though it contains numbers.

Choose the correct answer below.

- **A.** Social Security Number is a qualitative variable since there are a finite or countable number of values.
- **B.** Social Security Number is a qualitative variable since there are an infinite number of possible values that are not countable.
- **C.** Since Social Security Number is a variable at the interval level of measurement, it must be qualitative rather than quantitative.
- **D.** Addition and subtraction of Social Security Numbers does not provide meaningful results. This makes it qualitative even though it is numeric.

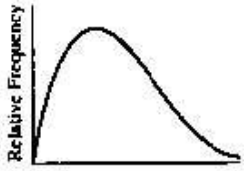
7. Fill in the blank.

A quantitative variable that has a finite or countable number of values is called _____.

A quantitative variable that has a finite or countable number of values is called (1) _____

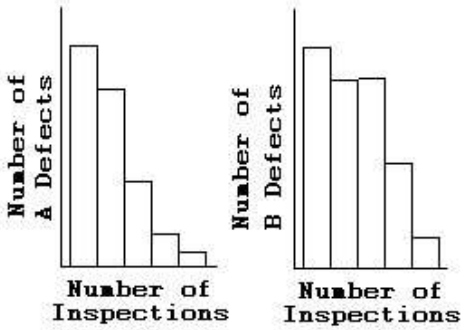
(1)
- discrete.
- continuous.
- nominal.
- qualitative.
- interval.
- ratio.
- ordinal.

8. Describe the shape of the distribution.



- **A.** skewed to the right
- **B.** bell shaped
- **C.** uniform
- **D.** skewed to the left

9. Is either histogram symmetric?



- **A.** Neither is symmetric.
- **B.** The second is symmetric, but the first is not symmetric.
- **C.** Both are symmetric.
- **D.** The first is symmetric, but the second is not symmetric.

10. Fill in the blank.

A quantitative variable that has an infinite number of possible values that are not countable is called _____.

A quantitative variable that has an infinite number of possible values that are not countable is called (1) _____

(1) ○ continuous. ○ ratio.
○ nominal. ○ interval.
○ ordinal. ○ qualitative.
○ discrete.

11. Fill in the blank to complete the statement below.

A _____ variable classifies individuals based on some attribute or characteristic.

A (1) _____ variable classifies individuals based on some attribute or characteristic.

(1) ○ quantitative
○ discrete
○ continuous
○ qualitative

12. Find the population mean or sample mean as indicated.

Sample: 18, 13, 9, 3, 22

Select the correct choice below and fill in the answer box to complete your choice.

○ **A.** $\mu =$ ☐

○ **B.** $\bar{x} =$ ☐

13. Find the population variance and standard deviation.

3, 6, 10, 12, 14

Choose the correct answer below. Fill in the answer box to complete your choice.
(Type an integer or a decimal. Do not round.)

○ **A.** $\sigma^2 =$ ☐

○ **B.** $s^2 =$ ☐

Choose the correct answer below. Fill in the answer box to complete your choice.
(Type an integer or a decimal. Do not round.)

○ **A.** $s =$ ☐

○ **B.** $\sigma =$ ☐

14. Many firms use on-the-job training to teach their employees new software. Suppose you work in the personnel department of a firm that just finished training a group of its employees in new software, and you have been requested to review the performance of one of the trainees on the final test that was given to all trainees. The mean and standard deviation of the test scores are 81 and 5, respectively, and the distribution of scores is mound-shaped and symmetric. Suppose the trainee in question received a score of 77. Compute the trainee's z-score, rounding to two decimal places.

- **A.** $z = 0.89$
- **B.** $z = 0.8$
- **C.** $z = -0.89$
- **D.** $z = -0.80$

15. A student scores 62 on a geography test and 270 on a mathematics test. The geography test has a mean of 80 and a standard deviation of 15. The mathematics test has a mean of 300 and a standard deviation of 20. If the data for both tests are normally distributed, on which test did the student score better relative to the other students in each class?

- **A.** The student scored better on the mathematics test.
- **B.** The student scored better on the geography test.
- **C.** The student scored the same on both tests.

16. Explain the meaning of the accompanying percentiles.
The 5th percentile of the head circumference of males 3 to 5 months of age in a certain city is 41.0 cm.

Explain the meaning of "The 5th percentile of the head circumference of males 3 to 5 months of age in a certain city is 41.0 cm." Choose the correct answer below.

- **A.** 5% of 3- to 5-month-old males have a head circumference that is 41.0 cm or more.
- **B.** 95% of 3- to 5-month-old males have a head circumference that is 41.0 cm or less.
- **C.** 5% of males have a head circumference that is 41.0 cm or less.
- **D.** 5% of 3- to 5-month-old males have a head circumference that is 41.0 cm or less.

17. Scores of an IQ test have a bell-shaped distribution with a mean of 100 and a standard deviation of 17. Use the empirical rule to determine the following.
(a) What percentage of people has an IQ score between 66 and 134?
(b) What percentage of people has an IQ score less than 49 or greater than 151?
(c) What percentage of people has an IQ score greater than 117?

(a) ____ % (Type an integer or a decimal.)

(b) ____ % (Type an integer or a decimal.)

(c) ____ % (Type an integer or a decimal.)

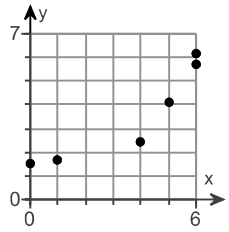
18. A data set is given below.

(a) Draw a scatter diagram. Comment on the type of relation that appears to exist between x and y.
(b) Given that $\bar{x} = 3.6667$, $s_x = 2.5820$, $\bar{y} = 3.6000$, $s_y = 2.0435$, and $r = -0.9628$, determine the least-squares regression line.
(c) Graph the least-squares regression line on the scatter diagram drawn in part (a).

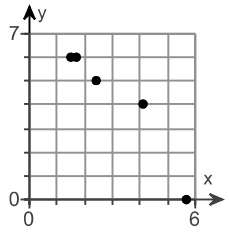
x	0	1	4	5	6	6
y	5.7	6.2	4.1	2.4	1.5	1.7

(a) Choose the correct graph below.

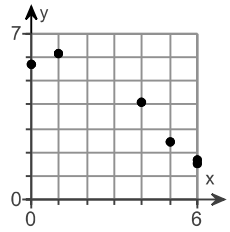
○ **A.**



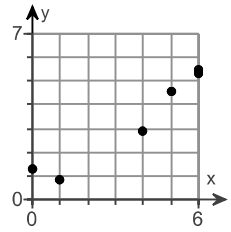
○ **B.**



○ **C.**



○ **D.**

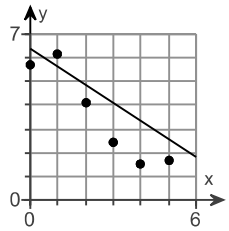


There appears to be (1) _____ relationship.

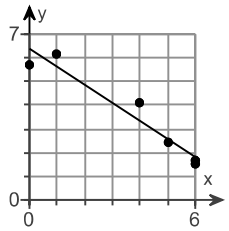
(b) $\hat{y} =$ [ ] x + ([ ])
(Round to three decimal places as needed.)

(c) Choose the correct graph below.

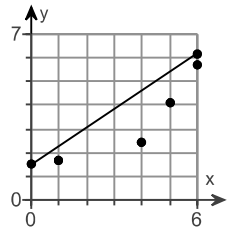
○ **A.**



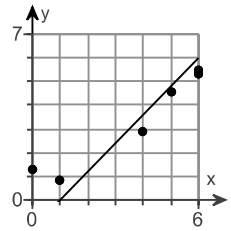
○ **B.**



○ **C.**



○ **D.**



(1) ○ a linear, positive ○ no
○ a nonlinear
○ a constant
○ a linear, negative

19. An engineer wants to determine how the weight of a gas-powered car, x, affects gas mileage, y. The accompanying data represent the weights of various domestic cars and their miles per gallon in the city for the most recent model year. Complete parts (a) through (d) below.
[1] Click here to view the weight and gas mileage data.

(a) Find the least-squares regression line treating weight as the explanatory variable and miles per gallon as the response variable.

$\hat{y}$ = [ ] x + ([ ])
(Round the x coefficient to five decimal places as needed. Round the constant to one decimal place as needed.)

(b) Interpret the slope and y-intercept, if appropriate. Choose the correct answer below and fill in any answer boxes in your choice. (Use the answer from part a to find this answer.)

- **A.** For every pound added to the weight of the car, gas mileage in the city will decrease by [ ] mile(s) per gallon, on average. A weightless car will get [ ] miles per gallon, on average.
- **B.** A weightless car will get [ ] miles per gallon, on average. It is not appropriate to interpret the slope.
- **C.** For every pound added to the weight of the car, gas mileage in the city will decrease by [ ] mile(s) per gallon, on average. It is not appropriate to interpret the y-intercept.
- **D.** It is not appropriate to interpret the slope or the y-intercept.

(c) A certain gas-powered car weighs 3678 pounds and gets 17 miles per gallon. Is the miles per gallon of this car above average or below average for cars of this weight?

The estimated average miles per gallon for cars of this weight is [ ] miles per gallon. The miles per gallon of this car is

(1) _____ average for cars of this weight.
(Round to three decimal places as needed.)

(d) Would it be reasonable to use the least-squares regression line to predict the miles per gallon of a hybrid gas and electric car? Why or why not?

- **A.** Yes, because the hybrid is partially powered by gas.
- **B.** Yes, because the absolute value of the correlation coefficient is greater than the critical value for a sample size of n = 10.
- **C.** No, because the hybrid is a different type of car.
- **D.** No, because the absolute value of the correlation coefficient is less than the critical value for a sample size of n = 10.

1: Car Weight and MPG

Weight (pounds), x	Miles per Gallon, y
3741	18
3798	15
2628	25
3628	18
3343	22
2952	24
3822	16
2677	24
3510	18
3701	17

(1) ◯ below
◯ above

20. A county real estate appraiser wants to develop a statistical model to predict the appraised value of houses in a section of the county called East Meadow. One of the many variables thought to be an important predictor of appraised value is the number of rooms in the house. Consequently, the appraiser decided to fit the simple linear regression model, $\hat{y} = b_1 x + b_0$ where y = appraised value of the house (in $thousands) and x = number of rooms. Using data collected for a sample of n = 74 houses in East Meadow, the accompanying results were obtained. Give a practical interpretation of the estimate of the slope of the least-squares regression line.
[2] Click the icon to view the regression results.

◯ **A.** For each additional dollar of appraised value, we estimate the number of rooms in the house to increase by 17.80 rooms.
◯ **B.** For each additional room in the house, we estimate the appraised value to increase $17,800
◯ **C.** For each additional room in the house, we estimate the appraised value to increase $74,800.
◯ **D.** For a house with 0 rooms, we estimate the appraised value to be $74,800.

2: Regression Results

$\hat{y} = 17.80x + 74.80$
$s_\beta = 71.24$, t = 1.05 (for testing b_0)
$s_\beta = 2.63$, t = 7.49 (for testing b_1)
SSE = 60,775, MSE = 841, s = 29, $r^2 = 0.44$
Range of the x-values: 5-11
Range of the y-values: 160-300

21. Use the linear correlation coefficient given to determine the coefficient of determination, R^2, rounding to two decimal places.

$r = -0.67$

◯ **A.** $R^2 = -81.85\%$
◯ **B.** $R^2 = 44.89\%$
◯ **C.** $R^2 = -44.89\%$
◯ **D.** $R^2 = 81.85\%$

22. Fill in the blank.

The _____, R^2, measures the proportion of total variation in the response variable that is explained by the least squares regression line.

The (1) _____ R^2, measures the proportion of total variation in the response variable that is explained by the least squares regression line.

(1) ◯ total deviation,
◯ coefficient of determination,
◯ residual,
◯ linear correlation coefficient,

*23. Suppose a doctor measures the height, x, and head circumference, y, of 8 children and obtains the data below. The correlation coefficient is 0.897 and the least squares regression line is $\hat{y} = 0.170x + 12.731$. Complete parts **(a)** and **(b)** below.

Height, x	27.25	25.25	26.25	25.00	28.00	26.50	26.25	27.00
Head Circumference, y	17.3	16.9	17.1	17.1	17.5	17.2	17.2	17.4

(a) Compute the coefficient of determination, R^2.

$R^2 =$ [ ] % (Round to one decimal place as needed.)

(b) Interpret the coefficient of determination and comment on the adequacy of the linear model.

- **A.** R^2 of the variation in head circumference is explained by the least-squares regression equation. The linear model appears to be appropriate.
- **B.** R^2 of the variation in head circumference is not explained by the least-squares regression equation. The linear model appears to be appropriate.
- **C.** R^2 of the variation in head circumference is not explained by the least-squares regression equation. The linear model appears to be not appropriate.
- **D.** R^2 of the variation in head circumference is explained by the least-squares regression equation. The linear model appears to be not appropriate.

24. In regression, what is the proportion of variation in the response variable that is explained by the regression model called?

Choose the correct answer below.

- The residual
- R^2
- Leverage
- The correlation coefficient

25. What is the definition of the correlation coefficient?

Choose the correct answer below.

- **A.** The correlation coefficient is a measure that describes the direction and strength of the linear relationship between two quantitative variables.
- **B.** The correlation coefficient is a measure that describes the direction and strength of the linear relationship between two qualitative variables.
- **C.** The correlation coefficient is a measure that describes the direction and strength of any relationship between two quantitative variables.
- **D.** The correlation coefficient is a measure that describes the direction and strength of any relationship between a qualitative variable and a quantitative variable.
- **E.** The correlation coefficient is a measure that describes the direction and strength of the linear relationship between a qualitative variable and a quantitative variable.

26. When looking at a scatterplot of two quantitative variables, what do we typically look for?

Choose the correct answer below.

- **A.** If the variation of the two variables is the same.
- **B.** The relationship between the two variables and if there are any deviations from the pattern (outliers or clusters of points, for example).
- **C.** If both the explanatory and response variables are normally distributed.
- **D.** If there is a difference in the means between the two variables.

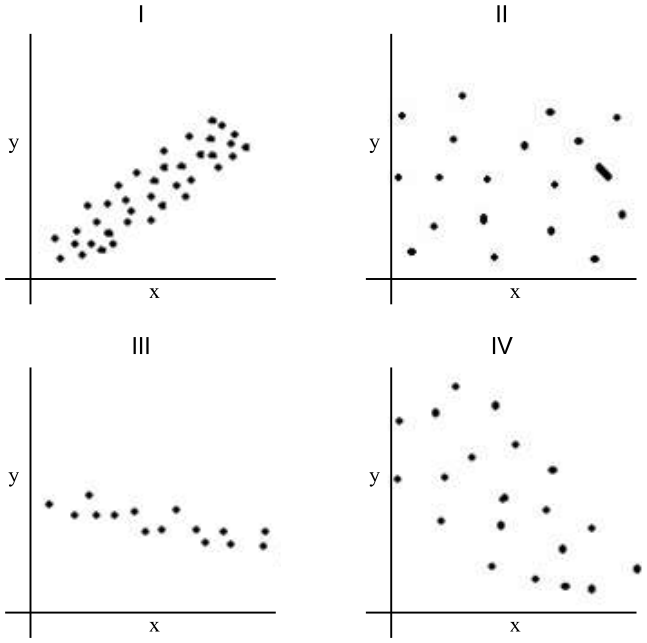
27. Review the accompanying scatterplots. Which of the four scatterplots corresponds to the highest R^2-value?

[3] Click the icon to view the scatterplots.

Choose the correct answer below.

- II
- III
- IV
- I

3: Scatterplots



28. Is the following a probability model? What do we call the outcome "red"?

Color	Probability
red	0
green	0.1
blue	0.15
brown	0.35
yellow	0.15
orange	0.25

Is the table above an example of a probability model?

- **A.** No, because not all the probabilities are greater than 0.
- **B.** Yes, because the probabilities sum to 1.
- **C.** No, because the probabilities do not sum to 1.
- **D.** Yes, because the probabilities sum to 1 and they are all greater than or equal to 0 and less than or equal to 1.

What do we call the outcome "red"?

- **A.** Impossible event
- **B.** Certain event
- **C.** Not so unusual event
- **D.** Unusual event

29. Find the probability P(E or F) if E and F are mutually exclusive, P(E) = 0.25, and P(F) = 0.45.

The probability P(E or F) is ____. (Simplify your answer.)

30. If E and F are disjoint events, then P(E or F) = (1) _____

(1)
- P(E).
- P(E and F).
- P(F).
- P(E) + P(F).
- P(E) + P(F) − P(E and F).

31. In a recent poll, a random sample of adults in some country (18 years and older) was asked, "When you see an ad emphasizing that a product is "Made in our country," are you more likely to buy it, less likely to buy it, or neither more nor less likely to buy it?" The results of the survey, by age group, are presented in the following contingency table. Complete parts (a) through (c).

Purchase likelihood	**18-34**	**35-44**	**45-54**	**55 +**	**Total**
More likely	226	319	330	410	**1285**
Less likely	24	9	22	13	**68**
Neither more nor less likely	284	201	157	120	**762**
Total	**534**	**529**	**509**	**543**	**2115**

(a) What is the probability that a randomly selected individual is 35 to 44 years of age, given the individual is neither more nor less likely to buy a product emphasized as "Made in our country"?

The probability is approximately ____.
(Round to three decimal places as needed.)

(b) What is the probability that a randomly selected individual is neither more nor less likely to buy a product emphasized as "Made in our country," given the individual is 35 to 44 years of age?

The probability is approximately ____.
(Round to three decimal places as needed.)

(c) Are 18- to 34-year-olds more likely to buy a product emphasized as "Made in our country" than individuals in general?

- Yes, more likely
- No, less likely

32. Determine whether the distribution is a discrete probability distribution.

x	100	200	300	400	500
P(x)	0.5	0.5	0.5	0.5	0.5

Is the distribution a discrete probability distribution?

- **A.** No, because the sum of the probabilities is not equal to 1.
- **B.** Yes, because the sum of the probabilities is equal to 1 and each probability is between 0 and 1, inclusive.
- **C.** No, because each probability is not between 0 and 1, inclusive.
- **D.** Yes, because the sum of the probabilities is equal to 1.

33. Find the probability $P(E^c)$ if P(E) = 0.33.

The probability $P(E^c)$ is ____. (Simplify your answer.)

34. Suppose that E and F are two events and that P(E) = 0.3 and P(F|E) = 0.6. What is P(E and F)?

P(E and F) = ☐
(Simplify your answer.)

35. Determine whether the random variable is discrete or continuous. In each case, state the possible values of the random variable.
(a) The number of customers arriving at a bank between noon and 1:00 P.M..
(b) The amount of rain in City B during April.

(a) Is the number of customers arriving at a bank between noon and 1:00 P.M. discrete or continuous?

- **A.** The random variable is discrete. The possible values are x = 0, 1, 2,....
- **B.** The random variable is continuous. The possible values are x = 0, 1, 2,....
- **C.** The random variable is discrete. The possible values are x ≥ 0.
- **D.** The random variable is continuous. The possible values are x ≥ 0.

(b) Is the amount of rain in City B during April discrete or continuous?

- **A.** The random variable is discrete. The possible values are r = 1, 2, 3, ...
- **B.** The random variable is continuous. The possible values are r = 1, 2, 3, ...
- **C.** The random variable is discrete. The possible values are r ≥ 0.
- **D.** The random variable is continuous. The possible values are r ≥ 0.

36. Determine the required value of the missing probability to make the distribution a discrete probability distribution.

x	P(x)
3	0.16
4	?
5	0.42
6	0.23

P(4) = ☐ (Type an integer or a decimal.)

37. Determine whether the distribution is a discrete probability distribution.

x	0	1	2	3	4
P(x)	0.06	0.23	0.11	0.21	0.28

Is the distribution a discrete probability distribution?

- **A.** Yes, because the sum of the probabilities is equal to 1.
- **B.** No, because each probability is not between 0 and 1, inclusive.
- **C.** Yes, because the sum of the probabilities is equal to 1 and each probability is between 0 and 1, inclusive.
- **D.** No, because the sum of the probabilities is not equal to 1.

38. Which of the following are criteria for a binomial probability experiment?

Select all that apply.

- ☐ **A.** The experiment is performed a fixed number of times.
- ☐ **B.** There are two mutually exclusive outcomes, success or failure.
- ☐ **C.** The probability of success is different for each trial of the experiment.
- ☐ **D.** Each trial depends on the previous trial.
- ☐ **E.** The trials are independent.
- ☐ **F.** The probability of success is the same for each trial of the experiment.
- ☐ **G.** The experiment is performed until a desired number of successes is reached.
- ☐ **H.** There are three mutually exclusive outcomes, arriving on-time, arriving early, and arriving late.

39. A binomial probability experiment is conducted with the given parameters. Use technology to find the probability of x successes in the n independent trials of the experiment.

$n = 7, p = 0.25, x < 4$

$P(X < 4) =$ ☐
(Round to four decimal places as needed.)

40. According to a study done by Nick Wilson of Otago University Wellington, the probability a randomly selected individual will not cover his or her mouth when sneezing is 0.267. Suppose you sit on a bench in a mall and observe people's habits as they sneeze. Complete parts (a) through (c).

(a) Using the binomial distribution, what is the probability that among 10 randomly observed individuals, exactly 4 do not cover their mouth when sneezing?

The probability is ☐.
(Round to four decimal places as needed.)

(b) Using the binomial distribution, what is the probability that among 10 randomly observed individuals, fewer than 5 do not cover their mouth when sneezing?

The probability is ☐.
(Round to four decimal places as needed.)

(c) Using the binomial distribution, would you be surprised if, after observing 10 individuals, fewer than half covered their mouth when sneezing? Why?

(1) _____ it (2) _____ be surprising, because the probability is ☐, which is (3) _____ 0.05.
(Round to four decimal places as needed.)

(1) ○ Yes, ○ No, (2) ○ would not ○ would (3) ○ greater than ○ less than

41. According to an almanac, 60% of adult smokers started smoking before turning 18 years old.
(a) Compute the mean and standard deviation of the random variable X, the number of smokers who started smoking before 18 based on a random sample of 100 adults.
(b) Interpret the mean.

(a) μ_x = ☐

σ_x = ☐ (Round to the nearest tenth as needed.)

(b) What is the correct interpretation of the mean?

- ○ **A.** It is expected that in 50% of random samples of 100 adult smokers, 60 will have started smoking before turning 18.
- ○ **B.** It is expected that in a random sample of 100 adult smokers, 60 will have started smoking before turning 18.
- ○ **C.** It is expected that in a random sample of 100 adult smokers, 60 will have started smoking after turning 18.

42. A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

n = 15, p = 0.65, x = 13

P(13) = ☐
(Do not round until the final answer. Then round to four decimal places as needed.)

43. A binomial probability experiment is conducted with the given parameters. Compute the probability of x successes in the n independent trials of the experiment.

n = 9, p = 0.5, x ≤ 3

The probability of x ≤ 3 successes is ☐. (Round to four decimal places as needed.)

44. According to an almanac, 80% of adult smokers started smoking before turning 18 years old.

(a) Compute the mean and standard deviation of the random variable X, the number of smokers who started before 18 in 300 trials of the probability experiment.
(b) Interpret the mean.
(c) Would it be unusual to observe 255 smokers who started smoking before turning 18 years old in a random sample of 300 adult smokers? Why?

(a) $\mu_x =$ ☐

$\sigma_x =$ ☐ (Round to the nearest tenth as needed.)

(b) What is the correct interpretation of the mean?

- **A.** It is expected that in 50% of random samples of 300 adult smokers, 240 will have started smoking before turning 18.
- **B.** It is expected that in a random sample of 300 adult smokers, 240 will have started smoking after turning 18.
- **C.** It is expected that in a random sample of 300 adult smokers, 240 will have started smoking before turning 18.

(c) Would it be unusual to observe 255 smokers who started smoking before turning 18 years old in a random sample of 300 adult smokers?

- **A.** Yes, because 255 is between $\mu - 2\sigma$ and $\mu + 2\sigma$.
- **B.** No, because 255 is greater than $\mu + 2\sigma$.
- **C.** Yes, because 255 is greater than $\mu + 2\sigma$.
- **D.** No, because 255 is less than $\mu - 2\sigma$.
- **E.** No, because 255 is between $\mu - 2\sigma$ and $\mu + 2\sigma$.

45. Which of the following are properties of the normal curve?

Select all that apply.

- ☐ **A.** The area under the normal curve to the right of the mean is 0.5.
- ☐ **B.** The area under the normal curve to the right of the mean is 1.
- ☐ **C.** The high point is located at the value of the standard deviation.
- ☐ **D.** The high point is located at the value of the mean.
- ☐ **E.** The graph of a normal curve is skewed right.
- ☐ **F.** The graph of a normal curve is symmetric.

46. Suppose that the lifetimes of light bulbs are approximately normally distributed, with a mean of 57 hours and a standard deviation of 3.5 hours. With this information, answer the following questions.

(a) What proportion of light bulbs will last more than 60 hours?
(b) What proportion of light bulbs will last 50 hours or less?
(c) What proportion of light bulbs will last between 57 and 61 hours?
(d) What is the probability that a randomly selected light bulb lasts less than 46 hours?

(a) The proportion of light bulbs that last more than 60 hours is ☐.
(Round to four decimal places as needed.)

(b) The proportion of light bulbs that last 50 hours or less is ☐.
(Round to four decimal places as needed.)

(c) The proportion of light bulbs that lasts between 57 and 61 hours is ☐.
(Round to four decimal places as needed.)

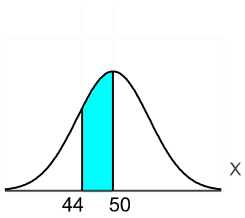
(d) The probability that a randomly selected light bulbs lasts less than 46 hours is ☐.
(Round to four decimal places as needed.)

47. Assume that the random variable X is normally distributed, with mean $\mu = 50$ and standard deviation $\sigma = 7$. Compute the probability. Be sure to draw a normal curve with the area corresponding to the probability shaded.

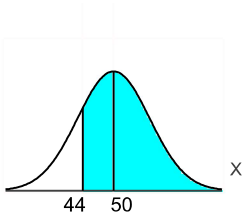
$P(X \leq 44)$

Which of the following shaded regions corresponds to $P(X \leq 44)$?

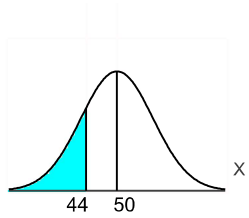
○ **A.**



○ **B.**



○ **C.**



$P(X \leq 44) =$ ☐
(Round to four decimal places as needed.)

48. The number of chocolate chips in an 18-ounce bag of chocolate chip cookies is approximately normally distributed with a mean of 1252 chips and standard deviation 129 chips.

(a) What is the probability that a randomly selected bag contains between 1000 and 1400 chocolate chips, inclusive?
(b) What is the probability that a randomly selected bag contains fewer than 1125 chocolate chips?
(c) What proportion of bags contains more than 1200 chocolate chips?
(d) What is the percentile rank of a bag that contains 1050 chocolate chips?

(a) The probability that a randomly selected bag contains between 1000 and 1400 chocolate chips, inclusive, is ☐.
(Round to four decimal places as needed.)

(b) The probability that a randomly selected bag contains fewer than 1125 chocolate chips is ☐.
(Round to four decimal places as needed.)

(c) The proportion of bags that contains more than 1200 chocolate chips is ☐.
(Round to four decimal places as needed.)

(d) A bag that contains 1050 chocolate chips is in the ☐th percentile.
(Round to the nearest integer as needed.)

49. The time required for an automotive center to complete an oil change service on an automobile approximately follows a normal distribution, with a mean of 19 minutes and a standard deviation of 3 minutes.

(a) The automotive center guarantees customers that the service will take no longer than 20 minutes. If it does take longer, the customer will receive the service for half-price. What percent of customers receive the service for half-price?
(b) If the automotive center does not want to give the discount to more than 5% of its customers, how long should it make the guaranteed time limit?

(a) The percent of customers that receive the service for half-price is [ ]%.
(Round to two decimal places as needed.)

(b) The guaranteed time limit is [ ] minutes. (Round up to the nearest integer as needed.)

50. Determine $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$ from the given parameters of the population and the sample size. Round the answer to three decimal places where appropriate.
$\mu = 40$, $\sigma = 30$, $n = 36$

- **A.** $\mu_{\bar{x}} = 40.000$, $\sigma_{\bar{x}} = 0.833$
- **B.** $\mu_{\bar{x}} = 40.000$, $\sigma_{\bar{x}} = 30.000$
- **C.** $\mu_{\bar{x}} = 40.000$, $\sigma_{\bar{x}} = 5.000$
- **D.** $\mu_{\bar{x}} = 6.667$, $\sigma_{\bar{x}} = 5.000$

51. A simple random sample of size $n = 49$ is obtained from a population that is skewed right with $\mu = 85$ and $\sigma = 7$.
(a) Describe the sampling distribution of $\bar{x}$.
(b) What is $P(\bar{x} > 86.95)$?
(c) What is $P(\bar{x} \le 82.5)$?
(d) What is $P(83.9 < \bar{x} < 86.95)$?

(a) Choose the correct description of the shape of the sampling distribution of $\bar{x}$.

- **A.** The distribution is skewed left.
- **B.** The distribution is approximately normal.
- **C.** The distribution is skewed right.
- **D.** The distribution is uniform.
- **E.** The shape of the distribution is unknown.

Find the mean and standard deviation of the sampling distribution of $\bar{x}$.

$\mu_{\bar{x}} =$ [ ]
$\sigma_{\bar{x}} =$ [ ]
(Type integers or decimals. Do not round.)

(b) $P(\bar{x} > 86.95) =$ [ ] (Round to four decimal places as needed.)

(c) $P(\bar{x} \le 82.5) =$ [ ] (Round to four decimal places as needed.)

(d) $P(83.9 < \bar{x} < 86.95) =$ [ ] (Round to four decimal places as needed.)

52. The acceptable level for insect filth in a certain food item is 3 insect fragments (larvae, eggs, body parts, and so on) per 10 grams. A simple random sample of 40 ten-gram portions of the food item is obtained and results in a sample mean of $\bar{x} = 3.3$ insect fragments per ten-gram portion. Complete parts **(a)** through **(c)** below.

(a) Why is the sampling distribution of $\bar{x}$ approximately normal?

- **A.** The sampling distribution of $\bar{x}$ is approximately normal because the population is normally distributed and the sample size is large enough.
- **B.** The sampling distribution of $\bar{x}$ is approximately normal because the population is normally distributed.
- **C.** The sampling distribution of $\bar{x}$ is approximately normal because the sample size is large enough.
- **D.** The sampling distribution of $\bar{x}$ is assumed to be approximately normal.

(b) What is the mean and standard deviation of the sampling distribution of $\bar{x}$ assuming $\mu = 3$ and $\sigma = \sqrt{3}$?

$\mu_{\bar{x}} =$ [ ] (Round to three decimal places as needed.)

$\sigma_{\bar{x}} =$ [ ] (Round to three decimal places as needed.)

(c) What is the probability a simple random sample of 40 ten-gram portions of the food item results in a mean of at least 3.3 insect fragments?

$P(\bar{x} \geq 3.3) =$ [ ] (Round to four decimal places as needed.)

Is this result unusual?

- **A.** This result is not unusual because its probability is large.
- **B.** This result is unusual because its probability is small.
- **C.** This result is not unusual because its probability is small.
- **D.** This result is unusual because its probability is large.

What might we conclude?

- **A.** Since this result is unusual, it is reasonable to conclude that the population mean is higher than 3.
- **B.** Since this result is not unusual, it is reasonable to conclude that the population mean is higher than 3.
- **C.** Since this result is not unusual, it is not reasonable to conclude that the population mean is higher than 3.
- **D.** Since this result is unusual, it is not reasonable to conclude that the population mean is higher than 3.

53. Complete the statement below.

A confidence interval for a population mean _____.

Choose the correct answer below.

- **A.** A confidence interval for a population mean gives possible values the sample mean will be with a certain level of confidence.
- **B.** A confidence interval for a population mean gives possible values the true population mean will be with 100% confidence.
- **C.** A confidence interval for a population mean gives possible values the true population mean will be with a certain level of confidence.
- **D.** A confidence interval for a population mean gives one possible value the true population mean will be with a certain level of confidence.

54. Which of the following is a correct explanation of what a confidence interval is?

Choose the correct answer below.

- **A.** A confidence interval is a range of values used to estimate the true value of a population parameter. The confidence level is the probability the interval actually contains the population parameter, assuming that the estimation process is repeated a large number of times.
- **B.** A confidence interval indicates how far off we're willing to be from the population mean with a certain level of confidence.
- **C.** A confidence interval gives two values (called the lower bound and upper bound) that the population mean could be with a certain level of confidence.
- **D.** A confidence interval gives a range of possible values for the mean of those in the sample with a certain level of confidence.
- **E.** A confidence interval gives an exact value for the population mean with a certain level of confidence.

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55. Days before a presidential election, an article based on a nationwide random sample of registered voters reported the following statistic, "52% (± 3%) of registered voters will vote for Robert Smith." What is the " ± 3%" called?

The " ± 3%" is called the _____.

- **A.** margin of error
- **B.** sample proportion
- **C.** confidence interval for a proportion
- **D.** standard error

---

56. Which of the following would increase the width of a confidence interval for a population mean?

Choose the correct answer below.

- **A.** Increase the sample size
- **B.** Decrease the sample standard deviation.
- **C.** Increase the level of confidence
- **D.** All of the above

---

57. Researchers studied the mean egg length (in millimeters) for a bird population. After taking a random sample of eggs, they obtained a 95% confidence interval of (45,60). What is the value of the margin of error?

Choose the correct answer below.

- **A.** 7.5 mm
- **B.** 15 mm
- **C.** 1.96
- **D.** 52.5 mm

---

58. A graduate student wanted to estimate the average time spent studying among graduate students at her school. She randomly sampled graduate students from her school and obtained a 99% confidence interval of (17.3,22.5) hours/week. In the context of the problem, which of the following interpretations is correct?

Choose the correct answer below.

- **A.** Approximately 99% of all random samples of graduate students from this school will give a mean number of hours studied per week between 17.3 and 22.5.
- **B.** At this student's school 99% of all graduate students study between 17.3 and 22.5 hours per week, on average.
- **C.** Graduate students at this student's school study between 17.3 and 22.5 hours per week 99% of all weeks during the year.
- **D.** There is a 99% chance that the average amount of time spent studying for all graduate students at this student's school is between 17.3 and 22.5 hours per week.
- **E.** We are 99% sure that the average amount of time spent studying among graduate students at this student's school is between 17.3 and 22.5 hours per week.

59. A graduate student wanted to estimate the average time spent studying among graduate students at her school. She randomly sampled graduate students from her school and obtained a 99% confidence interval of (17,25) hours/week. What is the margin of error?

Choose the correct answer below.

- **A.** 4 hours/week
- **B.** 8 hours/week
- **C.** 1.96
- **D.** 1%
- **E.** 21 hours/week

60. A graduate student wanted to estimate the average time spent studying among graduate students at her school. She randomly sampled graduate students from her school and obtained a 99% confidence interval of (17,25) hours/week. Which of the following would be true if the level of confidence was lowered to 95%?

Choose the correct answer below.

- **A.** The width of the confidence interval would remain the same.
- **B.** The width of the confidence interval would be smaller.
- **C.** The width of the confidence interval would be larger.
- **D.** More information is needed to determine what would happen to the width of the confidence interval.

61. Fill in the blank.

The margin of error is _____ the width of the confidence interval.

The margin of error is (1) _____ the width of the confidence interval.

(1) twice half the same as one-fourth 95% of

62. Construct a 99% confidence interval of the population proportion using the given information.

x = 240, n = 300

[4] Click here to view the table of critical values.

The lower bound is [ ].

The upper bound is [ ].
(Round to three decimal places as needed.)

4: Table of critical values

Level of Confidence, $(1-\alpha)\cdot 100\%$	Area in Each Tail, $\frac{\alpha}{2}$	Critical Value, $z_{\frac{\alpha}{2}}$
90%	0.05	1.645
95%	0.025	1.96
99%	0.005	2.575

63. Determine the point estimate of the population proportion, the margin of error for the following confidence interval, and the number of individuals in the sample with the specified characteristic, x, for the sample size provided.

Lower bound = 0.431, upper bound = 0.759, n = 1200

The point estimate of the population proportion is [ ].
(Round to the nearest thousandth as needed.)

The margin of error is [ ].
(Round to the nearest thousandth as needed.)

The number of individuals in the sample with the specified characteristic is [ ].
(Round to the nearest integer as needed.)

64. Suppose a polling agency reported that 43.1% of registered voters were in favor of raising income taxes to pay down the national debt. The agency states that results are based on telephone interviews with a random sample of 1049 registered voters. Suppose the agency states the margin of error for 90% confidence is 2.5%. Determine and interpret the confidence interval for the proportion of registered voters who are in favor of raising income taxes to pay down the national debt.

(1) _____ that the proportion of (2) _____ in favor of raising income taxes to pay down the national debt is between [ ] and [ ].
(Type integers or decimals rounded to three decimal places as needed. Use ascending order.)

(1) ○ We are 43.1% confident ○ We are 2.5% confident
○ We are 1049% confident ○ There is a 1049% probability
○ There is a 43.1% probability ○ There is a 2.5% probability
○ We are 90% confident ○ There is a 90% probability

(2) ○ adult Americans aged 18 or older
○ registered voters
○ all Americans

65. When 485 junior college students were surveyed, 100 said that they have previously owned a motorcycle. Find a point estimate for p, the population proportion of students who have previously owned a motorcycle, rounding to three decimal places.

○ **A.** 0.171
○ **B.** 0.260
○ **C.** 0.794
○ **D.** 0.206

66. It is thought that not as many Americans buy presents to celebrate Valentine's Day anymore. A random sample of 4000 Americans yielded 2200 who bought their significant other a present and celebrated Valentine's Day. Estimate the true proportion of all Americans who celebrate Valentine's Day using a 95% confidence interval. Express the answer in the form $\hat{p} \pm E$ and round to four decimal places.

- **A.** 0.5500 ± 0.4823
- **B.** 0.4375 ± 0.0154
- **C.** 0.5500 ± 0.0154
- **D.** 0.4375 ± 0.4823

67. It is thought that not as many Americans buy presents to celebrate Valentine's Day anymore. A random sample of 4000 Americans yielded 2200 who bought their significant other a present and celebrated Valentine's Day. What size sample should be obtained if a 90% confidence interval was desired to estimate the true proportion within 4%? Round up to the nearest whole number.

- **A.** 389
- **B.** 423
- **C.** 419
- **D.** 440

68. A simple random sample of size n is drawn. The sample mean, $\bar{x}$, is found to be 18.3, and the sample standard deviation, s, is found to be 4.6.
[5] Click the icon to view the table of areas under the t-distribution.

(a) Construct a 95% confidence interval about μ if the sample size, n, is 35.

Lower bound: ; Upper bound:
(Use ascending order. Round to two decimal places as needed.)

(b) Construct a 95% confidence interval about μ if the sample size, n, is 61.

Lower bound: ; Upper bound:
(Use ascending order. Round to two decimal places as needed.)

How does increasing the sample size affect the margin of error, E?

- **A.** The margin of error decreases.
- **B.** The margin of error does not change.
- **C.** The margin of error increases.

(c) Construct a 99% confidence interval about μ if the sample size, n, is 35.

Lower bound: ; Upper bound:
(Use ascending order. Round to two decimal places as needed.)

Compare the results to those obtained in part (a). How does increasing the level of confidence affect the size of the margin of error, E?

- **A.** The margin of error does not change.
- **B.** The margin of error decreases.
- **C.** The margin of error increases.

(d) If the sample size is 17, what conditions must be satisfied to compute the confidence interval?

- **A.** The sample data must come from a population that is normally distributed with no outliers.
- **B.** The sample must come from a population that is normally distributed and the sample size must be large.
- **C.** The sample size must be large and the sample should not have any outliers.

5: Table of t-Distribution Areas

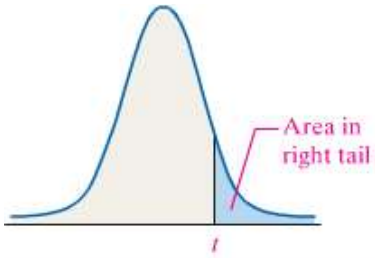


Table VI

t-Distribution
Area in Right Tail

df	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
1	1.000	1.376	1.963	3.078	6.314	12.706	15.894	31.821	63.657	127.321	318.309	636.61
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.089	22.327	31.59
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.215	12.92
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.61
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.86
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.95
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.40
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.04
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.78
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.58
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.43
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.31
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.22
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.14
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.07
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.01
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.96
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.610	3.92
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.88
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.85
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.81
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.79
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.76
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.74
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.72
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.70
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.69
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.67
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.65
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.64
31	0.682	0.853	1.054	1.309	1.696	2.040	2.144	2.453	2.744	3.022	3.375	3.63
32	0.682	0.853	1.054	1.309	1.694	2.037	2.141	2.449	2.738	3.015	3.365	3.62
33	0.682	0.853	1.053	1.308	1.692	2.035	2.138	2.445	2.733	3.008	3.356	3.61
34	0.682	0.852	1.052	1.307	1.691	2.032	2.136	2.441	2.728	3.002	3.348	3.60
35	0.682	0.852	1.052	1.306	1.690	2.030	2.133	2.438	2.724	2.996	3.340	3.59
36	0.681	0.852	1.052	1.306	1.688	2.028	2.131	2.434	2.719	2.990	3.333	3.58
37	0.681	0.851	1.051	1.305	1.687	2.026	2.129	2.431	2.715	2.985	3.326	3.57
38	0.681	0.851	1.051	1.304	1.686	2.024	2.127	2.429	2.712	2.980	3.319	3.56
39	0.681	0.851	1.050	1.304	1.685	2.023	2.125	2.426	2.708	2.976	3.313	3.55
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.55
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.49
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.46
70	0.678	0.847	1.044	1.294	1.667	1.994	2.093	2.381	2.648	2.899	3.211	3.43
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.41
90	0.677	0.846	1.042	1.291	1.662	1.987	2.084	2.368	2.632	2.878	3.183	3.40
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.39
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.30

z	0.674	0.842	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.090	3.29

df	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.000

Area in Right Tail

69. A doctor wants to estimate the mean HDL cholesterol of all 20- to 29-year-old females. How many subjects are needed to estimate the mean HDL cholesterol within 3 points with 99% confidence assuming s = 16.1 based on earlier studies? Suppose the doctor would be content with 95% confidence. How does the decrease in confidence affect the sample size required?
[6] Click the icon to view a partial table of critical values.

A 99% confidence level requires ____ subjects. (Round up to the nearest subject.)

A 95% confidence level requires ____ subjects. (Round up to the nearest subject.)

How does the decrease in confidence affect the sample size required?

- **A.** The sample size is the same for all levels of confidence.
- **B.** Decreasing the confidence level increases the sample size needed.
- **C.** Decreasing the confidence level decreases the sample size needed.

6: Partial Critical Value Table

Level of Confidence, $(1-\alpha)\cdot 100\%$	Area in Each Tail, $\frac{\alpha}{2}$	Critical Value, $z_{\alpha/2}$
90%	0.05	1.645
95%	0.025	1.96
99%	0.005	2.575

70. A television sports commentator wants to estimate the proportion of citizens who "follow professional football." Complete parts (a) through (c).

Click here to view the standard normal distribution table (page 1).[7]
Click here to view the standard normal distribution table (page 2).[8]

(a) What sample size should be obtained if he wants to be within 2 percentage points with 95% confidence if he uses an estimate of 52% obtained from a poll?

The sample size is [ ]. (Round up to the nearest integer.)

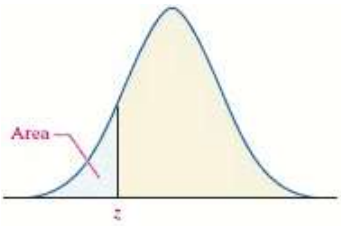
(b) What sample size should be obtained if he wants to be within 2 percentage points with 95% confidence if he does not use any prior estimates?

The sample size is [ ]. (Round up to the nearest integer.)

(c) Why are the results from parts (a) and (b) so close?

- **A.** The results are close because $0.52(1 - 0.52) = 0.2496$ is very close to 0.25.
- **B.** The results are close because the confidence 95% is close to 100%.
- **C.** The results are close because the margin of error 2% is less than 5%.

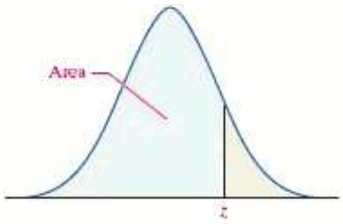
7: Standard Normal Distribution Table (page 1)



Standard Normal Distribution

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

8: Standard Normal Distribution Table (page 2)



Standard Normal Distribution

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

71. A researcher wishes to estimate the proportion of adults who have high-speed Internet access. What size sample should be obtained if she wishes the estimate to be within 0.05 with 95% confidence if
(a) she uses a previous estimate of 0.38?
(b) she does not use any prior estimates?

[9] Click the icon to view the table of critical values.

(a) n = ☐ (Round up to the nearest integer.)

(b) n = ☐ (Round up to the nearest integer.)

9: Table of critical values

Level of Confidence, $(1-\alpha)\cdot 100\%$	Area in Each Tail, $\frac{\alpha}{2}$	Critical Value, $z_{\frac{\alpha}{2}}$
90%	0.05	1.645
95%	0.025	1.96
99%	0.005	2.575

72. Eric randomly surveyed 150 adults from a certain city and asked which team in a contest they were rooting for, either North High School or South High School. Of the surveyed adults, 96 said they were rooting for North High while the rest said they were rooting for South High. Eric wants to determine if this is evidence that more than half the adults in this city will root for North High School. Which of the following is the correct null hypothesis?

Choose the correct answer below.

- **A.** H_0: p = 0.64, where p = the proportion of all adults in this city rooting for North High School
- **B.** H_0: $p_{North\ High} = p_{South\ High}$
- **C.** H_0: p > 0.5, where p = the proportion of all adults in this city rooting for North High School
- **D.** H_0: p = 0.5, where p = the proportion of all adults in this city rooting for North High School

73. Eric randomly surveyed 150 adults from a certain city and asked which team in a contest they were rooting for, either North High School or South High School. Of the surveyed adults, 96 said they were rooting for North High while the rest said they were rooting for South High. Eric wants to determine if this is evidence that more than half the adults in this city will root for North High School. Which of the following is the correct alternative hypothesis?

Choose the correct answer below.

- **A.** H_1: p = 0.5, where p = the proportion of all adults in this city rooting for North High School
- **B.** H_1: p > 0.5, where p = the proportion of all adults in this city rooting for North High School
- **C.** H_1: p = 0.64, where p = the proportion of all adults in this city rooting for North High School
- **D.** H_1: $p_{North\ High} = p_{South\ High}$

74. Fill in the blank.

A p-value is the probability _____.

Choose the correct answer below.

- **A.** A p-value is the probability that the null hypothesis is true.
- **B.** A p-value is the probability of observing the actual result, a sample mean, for example, or something more unusual just by chance if the null hypothesis is true.
- **C.** A p-value is the probability of observing the actual result, a sample mean, for example, or something more unusual just by chance if the null hypothesis is false.
- **D.** A p-value is the probability of observing the actual result, a sample mean, for example.

75. Fill in the blank to complete the statement.

If we do not reject the null hypothesis when the statement in the alternative hypothesis is true, we have made a Type _____ error.

If we do not reject the null hypothesis when the statement in the alternative hypothesis is true, we have made a Type

(1) _____ error.

(1)
- II
- I

76. If a hypothesis is tested at the $\alpha = 0.05$ level of significance, what is the probability of making a type I error?

Choose the correct answer below.

- **A.** The probability of making a type I error is 0.05.
- **B.** The probability of making a type I error is 0.95.
- **C.** The probability of making a type I error is 0.5.
- **D.** There is insufficient information to determine the probability of a type I error.

77. Three years ago, the mean price of an existing single-family home was $243,767. A real estate broker believes that existing home prices in her neighborhood are higher.
(a) State the null and alternative hypotheses in words.
(b) State the null and alternative hypotheses symbolically.
(c) Explain what it would mean to make a Type I error.
(d) Explain what it would mean to make a Type II error.

(a) State the null hypothesis in words. Choose the correct answer below.

- **A.** The mean price of a single family home in the broker's neighborhood is $243,767.
- **B.** The mean price of a single family home in the broker's neighborhood is different from $243,767.
- **C.** The mean price of a single family home in any neighborhood is $243,767.
- **D.** The mean price of a single family home in the broker's neighborhood is greater than $243,767.

State the alternative hypothesis in words. Choose the correct answer below.

- **A.** The mean price of a single family home in the broker's neighborhood is greater than $243,767.
- **B.** The mean price of a single family home in the broker's neighborhood is different from $243,767.
- **C.** The mean price of a single family home in the broker's neighborhood is $243,767.
- **D.** The mean price of a single family home in any neighborhood is $243,767.

(b) State the hypotheses symbolically.

H_0: (1) _____ (2) _____ $ ☐

H_1: (3) _____ (4) _____ $ ☐
(Type integers or decimals. Do not round.)

(c) What would it mean to make a Type I error?

The broker (5) _____ the hypothesis that the mean price is (6) _____ $ ☐, when the true mean price is (7) _____ $ ☐.
(Type integers or decimals. Do not round.)

(d) What would it mean to make a Type II error?

The broker (8) _____ the hypothesis that the mean price is (9) _____ $ ☐, when the true mean price is (10) _____ $ ☐.
(Type integers or decimals. Do not round.)

(1) ○ μ ○ σ ○ p
(2) ○ > ○ < ○ ≠ ○ =
(3) ○ μ ○ σ ○ p
(4) ○ ≠ ○ > ○ < ○ =
(5) ○ fails to reject ○ rejects
(6) ○ greater than ○ different from ○ less than ○ equal to
(7) ○ greater than ○ equal to ○ different from ○ less than
(8) ○ fails to reject ○ rejects
(9) ○ equal to ○ less than ○ different from ○ greater than
(10) ○ equal to ○ greater than ○ less than ○ different from

78. State the conclusion based on the results of the test.

According to the report, the standard deviation of monthly cell phone bills was $49.18 three years ago. A researcher suspects that the standard deviation of monthly cell phone bills is less today. The null hypothesis is not rejected.

Choose the correct answer below.

- **A.** There is not sufficient evidence to conclude that the standard deviation of monthly cell phone bills is less than its level three years ago of $49.18.
- **B.** There is sufficient evidence to conclude that the standard deviation of monthly cell phone bills is different from its level three years ago of $49.18.
- **C.** There is sufficient evidence to conclude that the standard deviation of monthly cell phone bills is less than its level three years ago of $49.18.

79. State the conclusion based on the results of the test.

According to the Federal Housing Finance Board, the mean price of a single-family home two years ago was $299,800. A real estate broker believes that because of the recent credit crunch, the mean price has decreased since then. The null hypothesis is not rejected.

Choose the correct answer below.

- **A.** There is not sufficient evidence to conclude that the mean price of a single-family home has increased from its level two years ago of $299,800.
- **B.** There is not sufficient evidence to conclude that the mean price of a single-family home has decreased from its level two years ago of $299,800.
- **C.** There is sufficient evidence to conclude that the mean price of a single-family home has increased from its level two years ago of $299,800.
- **D.** There is sufficient evidence to conclude that the mean price of a single-family home has decreased from its level two years ago of $299,800.

80. According to the Centers for Disease Control and Prevention, 9.9% of high school students currently use electronic cigarettes. A high school counselor is concerned the use of e-cigs at her school is higher. Complete parts (a) through (c) below.

(a) Determine the null and alternative hypotheses.

H_0: (1) _____ (2) _____ ☐

H_1: (3) _____ (4) _____ ☐

(Type integers or decimals. Do not round.)

(b) If the sample data indicate that the null hypothesis should not be rejected, state the conclusion of the high school counselor.

- ○ **A.** There is not sufficient evidence to conclude that the proportion of high school students exceeds 0.099 at this counselor's high school.
- ○ **B.** There is sufficient evidence to conclude that the proportion of high school students stayed 0.099 at this counselor's high school.
- ○ **C.** There is not sufficient evidence to conclude that the proportion of high school students stayed 0.099 at this counselor's high school.
- ○ **D.** There is sufficient evidence to conclude that the proportion of high school students exceeds 0.099 at this counselor's high school.

(c) Suppose, in fact, that the proportion of students at the counselor's high school who use electronic cigarettes is 0.221. Was a type I or type II error committed?

- ○ **A.** A Type I error was committed because the sample evidence led the counselor to conclude the proportion of e-cig users was 0.221, when, in fact, the proportion is lower.
- ○ **B.** A Type II error was committed because the sample evidence led the counselor to conclude the proportion of e-cig users was 0.099, when, in fact, the proportion is higher.
- ○ **C.** A Type II error was committed because the sample evidence led the counselor to conclude the proportion of e-cig users was 0.221, when, in fact, the proportion is lower.
- ○ **D.** A Type I error was committed because the sample evidence led the counselor to conclude the proportion of e-cig users was 0.099, when, in fact, the proportion is higher.

(1) ○ μ ○ p ○ σ (2) ○ ≠ ○ > ○ = ○ < (3) ○ σ ○ p ○ μ (4) ○ ≠ ○ > ○ < ○ =

81. Fill in the blank.

The probability of observing the experiment result, a sample mean, for example, or something more unusual just by chance if the null hypothesis is true is the definition of _____.

The probability of observing the experiment result, a sample mean, for example, or something more unusual just by chance if the null hypothesis is true is the definition of (1) _____

(1) ○ the test statistic.
○ the alternative hypothesis.
○ a confidence interval.
○ a p-value.

82. Test the hypothesis using the P-value approach.

H_0: $p = 0.45$ versus H_1: $p < 0.45$
$n = 150$, $x = 62$, $\alpha = 0.05$

Perform the test using the P-value approach.

P-value = [ ] (Round to four decimal places as needed.)

Choose the correct answer below.

- **A.** Since P-value $< \alpha$, do not reject the null hypothesis.
- **B.** Since P-value $< \alpha$, reject the null hypothesis
- **C.** Since P-value $> \alpha$, do not reject the null hypothesis
- **D.** Since P-value $> \alpha$, reject the null hypothesis.

*83. In a clinical trial, 19 out of 850 patients taking a prescription drug complained of flulike symptoms. Suppose that it is known that 1.7% of patients taking competing drugs complain of flulike symptoms. Is there sufficient evidence to conclude that more than 1.7% of this drug's users experience flulike symptoms as a side effect at the $\alpha = 0.05$ level of significance?

What are the null and alternative hypotheses?

H_0: p (1) _____ [ ] versus H_1: p (2) _____ [ ]

Use technology to find the P-value.

P-value = [ ] (Round to three decimal places as needed.)

Choose the correct answer below.

- **A.** Since P-value $< \alpha$, reject the null hypothesis and conclude that there is sufficient evidence that more than 1.7% of the users experience flulike symptoms.
- **B.** Since P-value $> \alpha$, reject the null hypothesis and conclude that there is not sufficient evidence that more than 1.7% of the users experience flulike symptoms.
- **C.** Since P-value $< \alpha$, do not reject the null hypothesis and conclude that there is sufficient evidence that more than 1.7% of the users experience flulike symptoms.
- **D.** Since P-value $> \alpha$, do not reject the null hypothesis and conclude that there is not sufficient evidence that more than 1.7% of the users experience flulike symptoms.

(1) ○ < ○ = ○ > ○ ≠

(2) ○ > ○ = ○ < ○ ≠

*84. To test H_0: $\mu = 20$ versus H_1: $\mu < 20$, a simple random sample of size $n = 18$ is obtained from a population that is known to be normally distributed. Answer parts (a)-(d).

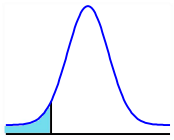
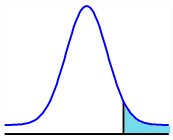
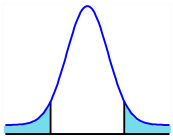
[10] Click here to view the t-Distribution Area in Right Tail.

(a) If $\bar{x} = 18.3$ and $s = 4$, compute the test statistic.

$t =$ [ ] (Round to two decimal places as needed.)

(b) Draw a t-distribution with the area that represents the P-value shaded. Which of the following graphs shows the correct shaded region?

○ **A.** ○ **B.** ○ **C.**

(c) Approximate the P-value. Choose the correct range for the P-value below.

○ **A.** $0.025 < \text{P-value} < 0.05$
○ **B.** $0.15 < \text{P-value} < 0.20$
○ **C.** $0.10 < \text{P-value} < 0.15$
○ **D.** $0.05 < \text{P-value} < 0.10$

(d) If the researcher decides to test this hypothesis at the $\alpha = 0.05$ level of significance, will the researcher reject the null hypothesis?

○ **A.** The researcher will reject the null hypothesis since the P-value is less than α.
○ **B.** The researcher will reject the null hypothesis since the P-value is not less than α.
○ **C.** The researcher will not reject the null hypothesis since the P-value is less than α.
○ **D.** The researcher will not reject the null hypothesis since the P-value is not less than α.

10: t-Distribution Area in Right Tail

t-Distribution
Area in Right Tail

df	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005	df
1	1.000	1.376	1.963	3.078	6.314	12.706	15.894	31.821	63.657	127.321	318.309	636.619	1
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.089	22.327	31.599	2
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.215	12.924	3
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610	4
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869	5
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959	6
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408	7
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041	8
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781	9
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587	10
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437	11
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318	12
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221	13
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140	14
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073	15
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015	16
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965	17
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.610	3.922	18
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883	19
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850	20
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819	21
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792	22
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768	23
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745	24
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725	25
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707	26
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690	27
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674	28
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659	29
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646	30
31	0.682	0.853	1.054	1.309	1.696	2.040	2.144	2.453	2.744	3.022	3.375	3.633	31
32	0.682	0.853	1.054	1.309	1.694	2.037	2.141	2.449	2.738	3.015	3.365	3.622	32
33	0.682	0.853	1.053	1.308	1.692	2.035	2.138	2.445	2.733	3.008	3.356	3.611	33
34	0.682	0.852	1.052	1.307	1.691	2.032	2.136	2.441	2.728	3.002	3.348	3.601	34
35	0.682	0.852	1.052	1.306	1.690	2.030	2.133	2.438	2.724	2.996	3.340	3.591	35
36	0.681	0.852	1.052	1.306	1.688	2.028	2.131	2.434	2.719	2.990	3.333	3.582	36
37	0.681	0.851	1.051	1.305	1.687	2.026	2.129	2.431	2.715	2.985	3.326	3.574	37
38	0.681	0.851	1.051	1.304	1.686	2.024	2.127	2.429	2.712	2.980	3.319	3.566	38
39	0.681	0.851	1.050	1.304	1.685	2.023	2.125	2.426	2.708	2.976	3.313	3.558	39
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551	40
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496	50
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460	60
70	0.678	0.847	1.044	1.294	1.667	1.994	2.093	2.381	2.648	2.899	3.211	3.435	70
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416	80
90	0.677	0.846	1.042	1.291	1.662	1.987	2.084	2.368	2.632	2.878	3.183	3.402	90
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390	100
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300	1000
z	0.674	0.842	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.090	3.291	z
df	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005	df

85. Test the hypothesis using the P-value approach. Be sure to verify the requirements of the test.

H_0: $p = 0.4$ versus H_1: $p > 0.4$

$n = 125$; $x = 65$, $\alpha = 0.05$

Is $np_0(1 - p_0) \geq 10$?

- ○ No
- ○ Yes

Use technology to find the P-value.

P-value = [ ]

(Round to three decimal places as needed.)

(1) _____ the null hypothesis, because the P-value is (2) _____ than α.

(1) ○ Reject ○ Do not reject

(2) ○ greater ○ less

---

86. Several years ago, the mean height of women 20 years of age or older was 63.7 inches. Suppose that a random sample of 45 women who are 20 years of age or older today results in a mean height of 64.2 inches.
(a) State the appropriate null and alternative hypotheses to assess whether women are taller today.
(b) Suppose the P-value for this test is 0.02. Explain what this value represents.
(c) Write a conclusion for this hypothesis test assuming an $\alpha = 0.10$ level of significance.

(a) State the appropriate null and alternative hypotheses to assess whether women are taller today.

- ○ **A.** H_0: $\mu = 63.7$ in. versus H_1: $\mu < 63.7$ in.
- ○ **B.** H_0: $\mu = 64.2$ in. versus H_1: $\mu \neq 64.2$ in.
- ○ **C.** H_0: $\mu = 64.2$ in. versus H_1: $\mu > 64.2$ in.
- ○ **D.** H_0: $\mu = 63.7$ in. versus H_1: $\mu \neq 63.7$ in.
- ○ **E.** H_0: $\mu = 64.2$ in. versus H_1: $\mu < 64.2$ in.
- ○ **F.** H_0: $\mu = 63.7$ in. versus H_1: $\mu > 63.7$ in.

(b) Suppose the P-value for this test is 0.02. Explain what this value represents.

- ○ **A.** There is a 0.02 probability of obtaining a sample mean height of exactly 64.2 inches from a population whose mean height is 63.7 inches.
- ○ **B.** There is a 0.02 probability of obtaining a sample mean height of 64.2 inches or taller from a population whose mean height is 63.7 inches.
- ○ **C.** There is a 0.02 probability of obtaining a sample mean height of 63.7 inches or taller from a population whose mean height is 64.2 inches.
- ○ **D.** There is a 0.02 probability of obtaining a sample mean height of 64.2 inches or shorter from a population whose mean height is 63.7 inches.

(c) Write a conclusion for this hypothesis test assuming an $\alpha = 0.10$ level of significance.

- ○ **A.** Reject the null hypothesis. There is not sufficient evidence to conclude that the mean height of women 20 years of age or older is greater today.
- ○ **B.** Reject the null hypothesis. There is sufficient evidence to conclude that the mean height of women 20 years of age or older is greater today.
- ○ **C.** Do not reject the null hypothesis. There is not sufficient evidence to conclude that the mean height of women 20 years of age or older is greater today.
- ○ **D.** Do not reject the null hypothesis. There is sufficient evidence to conclude that the mean height of women 20 years of age or older is greater today.

---

87. Conduct the following test at the $\alpha = 0.01$ level of significance by determining **(a)** the null and alternative hypotheses, **(b)** the test statistic, and **(c)** the P-value. Assume that the samples were obtained independently using simple random sampling.

Test whether $p_1 \neq p_2$. Sample data are $x_1 = 28$, $n_1 = 254$, $x_2 = 38$, and $n_2 = 301$.

(a) Determine the null and alternative hypotheses. Choose the correct answer below.

- **A.** $H_0: p_1 = p_2$ versus $H_1: p_1 < p_2$
- **B.** $H_0: p_1 = p_2$ versus $H_1: p_1 \neq p_2$
- **C.** $H_0: p_1 = 0$ versus $H_1: p_1 = 0$
- **D.** $H_0: p_1 = p_2$ versus $H_1: p_1 > p_2$

(b) The test statistic z_0 is [ ]. (Round to two decimal places as needed.)

(c) The P-value is [ ]. (Round to three decimal places as needed.)

Test the null hypothesis. Choose the correct conclusion below.

- **A.** Do not reject the null hypothesis because there is sufficient evidence to conclude that $p_1 > p_2$.
- **B.** Reject the null hypothesis because there is sufficient evidence to conclude that $p_1 \neq p_2$.
- **C.** Do not reject the null hypothesis because there is not sufficient evidence to conclude that $p_1 \neq p_2$.
- **D.** Reject the null hypothesis because there is not sufficient evidence to conclude that $p_1 < p_2$.

88. Construct a 95% confidence interval for $p_1 - p_2$. The sample statistics listed below are from independent samples. Round to three decimal places.

Sample statistics: $n_1 = 50$, $x_1 = 35$, and $n_2 = 60$, $x_2 = 40$

- **A.** $(-0.871, 0.872)$
- **B.** $(-2.391, 3.112)$
- **C.** $(-1.341, 1.781)$
- **D.** $(-0.141, 0.208)$

89. Conduct the following test at the $\alpha = 0.05$ level of significance by determining **(a)** the null and alternative hypotheses, **(b)** the test statistic, and **(c)** the P-value. Assume that the samples were obtained independently using simple random sampling.

Test whether $p_1 \neq p_2$. Sample data are $x_1 = 28$, $n_1 = 255$, $x_2 = 36$, and $n_2 = 302$.

(a) Determine the null and alternative hypotheses. Choose the correct answer below.

- **A.** $H_0: p_1 = 0$ versus $H_1: p_1 = 0$
- **B.** $H_0: p_1 = p_2$ versus $H_1: p_1 \neq p_2$
- **C.** $H_0: p_1 = p_2$ versus $H_1: p_1 > p_2$
- **D.** $H_0: p_1 = p_2$ versus $H_1: p_1 < p_2$

(b) The test statistic z_0 is [ ]. (Round to two decimal places as needed.)

(c) The P-value is [ ]. (Round to three decimal places as needed.)

Test the null hypothesis. Choose the correct conclusion below.

- **A.** Do not reject the null hypothesis because there is not sufficient evidence to conclude that $p_1 \neq p_2$.
- **B.** Reject the null hypothesis because there is sufficient evidence to conclude that $p_1 \neq p_2$.
- **C.** Reject the null hypothesis because there is not sufficient evidence to conclude that $p_1 < p_2$.
- **D.** Do not reject the null hypothesis because there is sufficient evidence to conclude that $p_1 > p_2$.

---

90. In 2003, an organization surveyed 1,510 adult Americans and asked about a certain war, "Do you believe the United States made the right or wrong decision to use military force?" Of the 1,510 adult Americans surveyed, 1,086 stated the United States made the right decision. In 2008, the organization asked the same question of 1,510 adult Americans and found that 575 believed the United States made the right decision. Construct and interpret a 90% confidence interval for the difference between the two population proportions, $p_{2003} - p_{2008}$.

The lower bound of a 90% confidence interval is [ ].
(Round to three decimal places as needed.)

The upper bound of a 90% confidence interval is [ ].
(Round to three decimal places as needed.)

Interpret the 90% confidence interval for the difference between the two population proportions, $p_{2003} - p_{2008}$. Choose the correct answer below.

- **A.** There is 90% confidence that the difference in the proportion of adult Americans from 2003 to 2008 who believe the United States made the right decision to use military force in the country is greater than the lower bound.
- **B.** There is 90% confidence that the difference in the proportion of adult Americans from 2003 to 2008 who believe the United States made the right decision to use military force in the country is between the lower and upper bounds of the interval.
- **C.** There is 10% confidence that the difference in the proportion of adult Americans from 2003 to 2008 who believe the United States made the right decision to use military force in the country is between the lower and upper bounds of the interval.

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91. In an experiment, 17 babies were asked to watch a climber attempt to ascend a hill. On two occasions, the baby witnesses the climber fail to make the climb. Then, the baby witnesses either a helper toy push the climber up the hill, or a hinderer toy preventing the climber from making the ascent. The toys were shown to each baby in a random fashion. A second part of this experiment showed the climber approach the helper toy, which is not a surprising action, and then the climber approached the hinderer toy, which is a surprising action. The amount of time the baby watched the event was recorded. The mean difference in time spent watching the climber approach the hinderer toy versus watching the climber approach the helper toy was 1.25 seconds with a standard deviation of 1.51 seconds. Complete parts a through c.

(a) State the null and alternative hypotheses to determine if babies tend to look at the hinderer toy longer than the helper toy. Let $\mu_d = \mu_{hinderer} - \mu_{helper}$, where $\mu_{hinderer}$ is the population mean time babies spend watching the climber approach the hinderer toy and μ_{helper} is the population mean time babies spend watching the climber approach the helper toy.

- **A.** $H_0: \mu_d > 0$, $H_1: \mu_d = 0$
- **B.** $H_0: \mu_d \neq 0$, $H_1: \mu_d = 0$
- **C.** $H_0: \mu_d < 0$, $H_1: \mu_d = 0$
- **D.** $H_0: \mu_d = 0$, $H_1: \mu_d < 0$
- **E.** $H_0: \mu_d = 0$, $H_1: \mu_d \neq 0$
- **F.** $H_0: \mu_d = 0$, $H_1: \mu_d > 0$

(b) Assuming the differences are normally distributed with no outliers, test if the difference in the amount of time the baby will watch the hinderer toy versus the helper toy is greater than 0 at the 0.05 level of significance.

Find the test statistic for this hypothesis test.

[ ] (Round to two decimal places as needed.)

Determine the P-value for this hypothesis test.

[ ] (Round to three decimal places as needed.)

State the conclusion for this hypothesis test.

- **A.** Do not reject H_0. There is sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that the difference is greater than 0.
- **B.** Reject H_0. There is sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that the difference is greater than 0.
- **C.** Reject H_0. There is not sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that the difference is greater than 0.
- **D.** Do not reject H_0. There is not sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that the difference is greater than 0.

(c) What do you think the results of this experiment imply about babies' ability to assess surprising behavior?

- **A.** The experiment does not imply anything about babies' ability to assess surprising behavior.
- **B.** There is sufficient evidence that babies do not have the ability to assess surprising behavior.
- **C.** There is not sufficient evidence that babies do not have the ability to assess surprising behavior.
- **D.** There is not sufficient evidence that babies have the ability to assess surprising behavior.
- **E.** There is sufficient evidence that babies have the ability to assess surprising behavior.

92. To test the belief that sons are taller than their fathers, a student randomly selects 13 fathers who have adult male children. She records the height of both the father and son in inches and obtains the following data. Are sons taller than their fathers? Use the $\alpha = 0.10$ level of significance. Note: A normal probability plot and boxplot of the data indicate that the differences are approximately normally distributed with no outliers.
[11] Click the icon to view the table of data.

Which conditions must be met by the sample for this test? Select all that apply.

- ☐ **A.** The sample size is no more than 5% of the population size.
- ☐ **B.** The sampling method results in an independent sample.
- ☐ **C.** The sample size must be large.
- ☐ **D.** The sampling method results in a dependent sample.
- ☐ **E.** The differences are normally distributed or the sample size is large.

Let $d_i = X_i - Y_i$. Write the hypotheses for the test.

H_0: (1) _____

H_1: (2) _____

Calculate the test statistic.

$t_0 =$ ☐ (Round to two decimal places as needed.)

Calculate the P-value.

P-value = ☐ (Round to three decimal places as needed.)

Should the null hypothesis be rejected?

(3) _____ H_0 because the P-value is (4) _____ the level of significance. There (5) _____ sufficient evidence to conclude that sons (6) _____ their fathers at the 0.10 level of significance.

11: Table of height data

Height of Father, X_i	Height of Son, Y_i
67.5	72.6
70.8	74.3
73.1	75.6
66.7	68.4
70.7	71.9
72.8	73.3
67.1	67.2
71.3	70.8
70.4	69.3
68.4	66.6
71.3	68.8
68.4	64.9
72.8	67.9

(1) ○ $\mu_d \neq 0$
○ $\mu_d = 0$
○ $\mu_d < 0$
○ $\mu_d > 0$

(2) ○ $\mu_d < 0$
○ $\mu_d \neq 0$
○ $\mu_d > 0$
○ $\mu_d = 0$

(3) ○ Do not reject
○ Reject

(4) ○ less than
○ greater than

(5) ○ is
○ is not

(6) ○ are shorter than
○ are taller than
○ are the same height as
○ are not the same height as

---

93. A researcher studies water clarity at the same location in a lake on the same dates during the course of a year and repeats the measurements on the same dates 5 years later. The researcher immerses a weighted disk painted black and white and measures the depth (in inches) at which it is no longer visible. The collected data is given in the table below. Complete parts (a) through (c) below.

Observation	1	2	3	4	5	6
Date	1/25	3/19	5/30	7/3	9/13	11/7
Initial Depth, X_i	47.8	61.5	41.8	50.6	47.7	37.8
Depth Five Years Later, Y_i	48.6	58.6	46.9	49.2	55.9	34.2

[12] Click the icon to view the table of critical t-values.

a) Why is it important to take the measurements on the same date?

- **A.** Using the same dates makes the second sample dependent on the first and reduces variability in water clarity attributable to date.
- **B.** Those are the same dates that all biologists use to take water clarity samples.
- **C.** Using the same dates maximizes the difference in water clarity.
- **D.** Using the same dates makes it easier to remember to take samples.

b) Does the evidence suggest that the clarity of the lake is improving at the $\alpha = 0.05$ level of significance? Note that the normal probability plot and boxplot of the data indicate that the differences are approximately normally distributed with no outliers.

Let $d_i = X_i - Y_i$. Identify the null and alternative hypotheses.

H_0: μ_d (1) _____ ☐

H_1: μ_d (2) _____ ☐

Determine the test statistic for this hypothesis test.

☐ (Round to two decimal places as needed.)

Find the critical value(s) for this hypothesis test.

☐

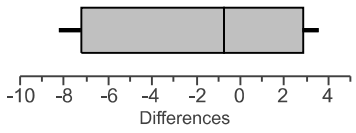
(Use a comma to separate answers as needed. Round to two decimal places as needed.)

What is your conclusion regarding H_0?

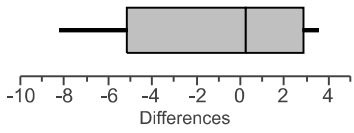
(3) _____ H_0. There (4) _____ sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that the clarity of the lake is improving.

c) Draw a boxplot of the differenced data. Does this visual evidence support the results obtained in part (b)?

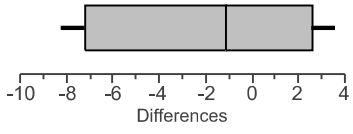
- **A.**



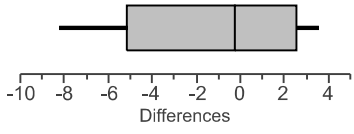
- **B.**



- **C.**



- **D.**

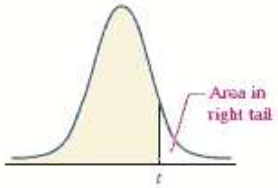


Does this visual evidence support the results obtained in part (b)?

- **A.** Yes, because 0 is contained in the boxplot.
- **B.** Yes, because the boxplot shows no outliers.
- **C.** No, because the boxplot is too large.

◯ **D.** No, because 0 is not contained in the boxplot.

12: Table of Critical t-Values



t-Distribution
Area in Right Tail

Degrees of Freedom	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
1	1.000	1.376	1.963	3.078	6.314	12.706	15.894	31.821	63.657	127.321	318.309	636.619
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.089	22.327	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.215	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.610	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
31	0.682	0.853	1.054	1.309	1.696	2.040	2.144	2.453	2.744	3.022	3.375	3.633
32	0.682	0.853	1.054	1.309	1.694	2.037	2.141	2.449	2.738	3.015	3.365	3.622
33	0.682	0.853	1.053	1.308	1.692	2.035	2.138	2.445	2.733	3.008	3.356	3.611
34	0.682	0.852	1.052	1.307	1.691	2.032	2.136	2.441	2.728	3.002	3.348	3.601
35	0.682	0.852	1.052	1.306	1.690	2.030	2.133	2.438	2.724	2.996	3.340	3.591
36	0.681	0.852	1.052	1.306	1.688	2.028	2.131	2.434	2.719	2.990	3.333	3.582
37	0.681	0.851	1.051	1.305	1.687	2.026	2.129	2.431	2.715	2.985	3.326	3.574
38	0.681	0.851	1.051	1.304	1.686	2.024	2.127	2.429	2.712	2.980	3.319	3.566
39	0.681	0.851	1.050	1.304	1.685	2.023	2.125	2.426	2.708	2.976	3.313	3.558
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
70	0.678	0.847	1.044	1.294	1.667	1.994	2.093	2.381	2.648	2.899	3.211	3.435
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
90	0.677	0.846	1.042	1.291	1.662	1.987	2.084	2.368	2.632	2.878	3.183	3.402
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
z	0.674	0.842	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.090	3.291
Degrees of Freedom	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005

t-Distribution
Area in Right Tail

(1) ◯ > ◯ < ◯ ≠ ◯ =

(2) ◯ > ◯ = ◯ < ◯ ≠

(3) ◯ Reject ◯ Do not reject

(4) ◯ is not ◯ is

94. Assume that both populations are normally distributed.
a) Test whether $\mu_1 \neq \mu_2$ at the $\alpha = 0.05$ level of significance for the given sample data.
b) Construct a 95% confidence interval about $\mu_1 - \mu_2$.

	Sample 1	Sample 2
n	18	18
$\bar{\mathbf{x}}$	18.7	15.4
s	5.4	3.3

[13] Click the icon to view the Student's t-distribution table.

a) Perform a hypothesis test. Determine the null and alternative hypotheses.

- **A.** $H_0: \mu_1 = \mu_2, H_1: \mu_1 > \mu_2$
- **B.** $H_0: \mu_1 = \mu_2, H_1: \mu_1 < \mu_2$
- **C.** $H_0: \mu_1 = \mu_2, H_1: \mu_1 \neq \mu_2$
- **D.** $H_0: \mu_1 \neq \mu_2, H_1: \mu_1 = \mu_2$

Determine the test statistic.

t = [ ] (Round to two decimal places as needed.)

Approximate the P-value. Choose the correct answer below.

- **A.** P-value < 0.01
- **B.** 0.01 ≤ P-value < 0.05
- **C.** P-value ≥ 0.10
- **D.** 0.05 ≤ P-value < 0.10

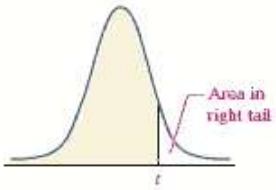
Should the hypothesis be rejected at the $\alpha = 0.05$ level of significance?

(1) _____ the null hypothesis because the P-value is (2) _____ the level of significance.

b) Construct a 95% confidence interval about $\mu_1 - \mu_2$.

The confidence interval is the range from [ ] to [ ].
(Round to two decimal places as needed. Use ascending order.)

13: Student's t-Distribution Table



t-Distribution
Area in Right Tail

Degrees of Freedom	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
1	1.000	1.376	1.963	3.078	6.314	12.706	15.894	31.821	63.657	127.321	318.309	636.619
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.089	22.327	31.599
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.215	12.924
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.610	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
31	0.682	0.853	1.054	1.309	1.696	2.040	2.144	2.453	2.744	3.022	3.375	3.633
32	0.682	0.853	1.054	1.309	1.694	2.037	2.141	2.449	2.738	3.015	3.365	3.622
33	0.682	0.853	1.053	1.308	1.692	2.035	2.138	2.445	2.733	3.008	3.356	3.611
34	0.682	0.852	1.052	1.307	1.691	2.032	2.136	2.441	2.728	3.002	3.348	3.601
35	0.682	0.852	1.052	1.306	1.690	2.030	2.133	2.438	2.724	2.996	3.340	3.591
36	0.681	0.852	1.052	1.306	1.688	2.028	2.131	2.434	2.719	2.990	3.333	3.582
37	0.681	0.851	1.051	1.305	1.687	2.026	2.129	2.431	2.715	2.985	3.326	3.574
38	0.681	0.851	1.051	1.304	1.686	2.024	2.127	2.429	2.712	2.980	3.319	3.566
39	0.681	0.851	1.050	1.304	1.685	2.023	2.125	2.426	2.708	2.976	3.313	3.558
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
70	0.678	0.847	1.044	1.294	1.667	1.994	2.093	2.381	2.648	2.899	3.211	3.435
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
90	0.677	0.846	1.042	1.291	1.662	1.987	2.084	2.368	2.632	2.878	3.183	3.402
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
z	0.674	0.842	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.090	3.291
Degrees of Freedom	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005

t-Distribution
Area in Right Tail

(1) ○ Do not reject ○ Reject (2) ○ greater than or equal to ○ less than

95. Assume that both populations are normally distributed.
(a) Test whether $\mu_1 \neq \mu_2$ at the $\alpha = 0.05$ level of significance for the given sample data.
(b) Construct a 95% confidence interval about $\mu_1 - \mu_2$.

	Population 1	Population 2
n	12	12
$\bar{x}$	11.9	10
s	2.9	3

(a) Test whether $\mu_1 \neq \mu_2$ at the $\alpha = 0.05$ level of significance for the given sample data.
Determine the null and alternative hypothesis for this test.

- **A.** $H_0: \mu_1 \neq \mu_2$
  $H_1: \mu_1 > \mu_2$
- **B.** $H_0: \mu_1 \neq \mu_2$
  $H_1: \mu_1 = \mu_2$
- **C.** $H_0: \mu_1 = \mu_2$
  $H_1: \mu_1 \neq \mu_2$
- **D.** $H_0: \mu_1 = \mu_2$
  $H_1: \mu_1 > \mu_2$

Detemine the P-value for this hypothesis test.

P = [ ] (Round to three decimal places as needed.)

Should the null hypothesis be rejected?

- **A.** Reject H_0, there is sufficient evidence to conclude that the two populations have different means.
- **B.** Do not reject H_0, there is not sufficient evidence to conclude that the two populations have different means.
- **C.** Do not reject H_0, there is sufficient evidence to conclude that the two populations have different means.
- **D.** Reject H_0, there is not sufficient evidence to conclude that the two populations have different means.

(b) Construct a 95% confidence interval about $\mu_1 - \mu_2$.

We are 95% confident that the mean difference is between [ ] and [ ].
(Round to two decimal places as needed. Use ascending order.)

96. Construct a 95% confidence interval for $\mu_1 - \mu_2$. Two samples are randomly selected from normal populations. The sample statistics are given below. Round to three decimal places.

$n_1 = 10$ $n_2 = 12$
$\bar{x}_1 = 25$ $\bar{x}_2 = 23$
$s_1 = 1.5$ $s_2 = 1.9$

- **A.** (0.579, 3.421)
- **B.** (0.487, 3.513)
- **C.** (1.554, 3.651)
- **D.** (1.413, 3.124)

97. A researcher wanted to determine if carpeted rooms contain more bacteria than uncarpeted rooms. The table shows the results for the number of bacteria per cubic foot for both types of rooms.

Full data set

Carpeted			Uncarpeted		
11.7	11.7	10.2	12	6.1	6.6
7.7	11.2	10.3	12	7.4	9.4
13.3	7.4		4.8	7.1	

Determine whether carpeted rooms have more bacteria than uncarpeted rooms at the $\alpha = 0.01$ level of significance. Normal probability plots indicate that the data are approximately normal and boxplots indicate that there are no outliers.

State the null and alternative hypotheses. Let population 1 be carpeted rooms and population 2 be uncarpeted rooms.

- **A.** $H_0: \mu_1 = \mu_2$
  $H_1: \mu_1 < \mu_2$
- **B.** $H_0: \mu_1 = \mu_2$
  $H_1: \mu_1 > \mu_2$
- **C.** $H_0: \mu_1 < \mu_2$
  $H_1: \mu_1 > \mu_2$
- **D.** $H_0: \mu_1 = \mu_2$
  $H_1: \mu_1 \neq \mu_2$

Determine the P-value for this hypothesis test.

P-value = [ ] (Round to three decimal places as needed.)

State the appropriate conclusion. Choose the correct answer below.

- **A.** Do not reject H_0. There is significant evidence at the $\alpha = 0.01$ level of significance to conclude that carpeted rooms have more bacteria than uncarpeted rooms.
- **B.** Reject H_0. There is significant evidence at the $\alpha = 0.01$ level of significance to conclude that carpeted rooms have more bacteria than uncarpeted rooms.
- **C.** Reject H_0. There is not significant evidence at the $\alpha = 0.01$ level of significance to conclude that carpeted rooms have more bacteria than uncarpeted rooms.
- **D.** Do not reject H_0. There is not significant evidence at the $\alpha = 0.01$ level of significance to conclude that carpeted rooms have more bacteria than uncarpeted rooms.

98. The website touringplans.com records actual wait times (in minutes) for the Pirates of the Caribbean ride and Splash Mountain ride at Walt Disney World. Do the wait times at these two rides differ? Answer parts (a) through (c).
Click here to view the sample wait times for part (a).[14]
Click here to view the sample wait times for part (b).[15]

(a) To answer this question, a random sample of wait times at each ride was obtained as shown in the accompanying table. Test whether the mean wait times at the two rides differ using $\alpha = 0.05$ level of significance.

State the null and alternative hypotheses.

H_0: (1) _____ (2) _____

H_1: (3) _____ (4) _____
(Type integers or decimals. Do not round.)

Because the data is treated as a simple random sample the sample sizer is large for each sample, the samples are independent, and each sample size is less than 5% of the population size, the Student's t-distribution may be used. Determine the test statistic.

The test statistic is _____.
(Round to two decimal places as needed.)

Determine the P-value for the hypotheses stated above.

The P-value is _____.
(Round to two decimal places as needed.)

If this study were conducted 100 independent times, one would expect _____ of them to result in a difference of sample means as extreme or more extreme than that observed if the mean wait time was (5) _____ for each ride.
(Round to the nearest whole number as needed.)

Because the P-value (6) _____ less than the level of significance 0.05, (7) _____ reject the statement in the null hypothesis. There (8) _____ sufficient evidence to conclude that the mean wait time for Pirates of the Caribbean is (9) _____ the mean wait time for Splash Mountain.

(b) A flaw in the analysis from part (a) is that it did not consider the date and time the wait time was measured. The data set for part (b) represents a random sample of wait times at each ride on the same date and at the same time of day. Use a matched-pairs design to test whether the mean wait times at the two rides differ using $\alpha = 0.05$ level of significance. Compute the differences as "Splash − Pirates". Note a normal probability plot suggest the differenced data is approximately normal and a boxplot shows no outliers.

State the null and alternative hypotheses.

H_0: (10) _____ (11) _____

H_1: (12) _____ (13) _____
(Type integers or decimals. Do not round.)

Determine the test statistic.

The test statistic is _____.
(Round to two decimal places as needed.)

Determine the P-value.

The P-value is _____.
(Round to two decimal places as needed.)

Because the P-value (14) _____ less than the level of significance 0.05, (15) _____ reject the statement in the null hypothesis. There (16) _____ sufficient evidence to conclude that the wait time for Pirates of the Caribbean is (17) _____ the wait time for Splash Mountain.

(c) Treating the data in part (b) as an independent sample, compute the sample mean difference ("Splash − Pirates") and standard error of the mean difference of this data. Compute the sample mean difference ("Splash − Pirates") and standard error of the mean difference

treating the data as a dependent sample. What did you find?

	Independent Sample	Dependent Sample
Mean Difference		
Standard Error		

(Round to two decimal places as needed.)

The mean difference is (18) _____ The standard error for the independent sample is (19) _____ the standard error for dependent sample.

14: Part (a) Sample Wait Times

Sample(Pirates)	Sample(Splash_Mtn)
24	21
6	49
2	18
12	47
10	36
1	3
23	0
22	31
21	18
33	37
3	14
6	21
9	1
2	13
39	15
13	13
1	22
33	8
2	20
7	32
34	1
16	2
29	36
4	16
1	20
18	9
22	9
34	73
42	3
2	3

15: Part (b) Sample Wait Times

Sample(Pirates)	Sample(Splash_Mtn)
3	0
8	17
15	17
9	20
7	25
2	26
32	29
8	23
39	6
31	35
3	4
1	20
2	26
3	32
8	6
13	25
2	15
3	6
12	1
3	9
0	21
12	29
2	3
0	17
14	20
2	21
11	24
7	3
12	18
14	5

(1) ○ $p_S - p_P$ ○ $\mu_S - \mu_P$ ○ $\sigma_S^2 - \sigma_P^2$ ○ $\sigma_S - \sigma_P$

(2) ○ < ○ > ○ = ○ ≠

(3) ○ $p_S - p_P$ ○ $\sigma_S^2 - \sigma_P^2$ ○ $\mu_S - \mu_P$ ○ $\sigma_S - \sigma_P$

(4) ○ = ○ < ○ ≠ ○ >

(5) ○ different ○ the same

(6) ○ is not ○ is

(7) ○ do ○ do not

(8) ○ is not ○ is

(9) ○ less than ○ greater than ○ different from

(10) ○ σ_D ○ σ_D^2 ○ p_D ○ μ_D

(11) ○ ≠ ○ > ○ < ○ =

(12) ○ p_D ○ μ_D ○ σ_D^2 ○ σ_D

(13) ○ = ○ < ○ > ○ ≠

(14) ○ is ○ is not

(15) ○ do ○ do not

(16) ○ is ○ is not

(17) ○ greater than ○ less than ○ different from

(18) ○ different. ○ the same.

(19) ○ greater than ○ less than ○ the same as

1. (1) parameter

---

2. (1) statistic

---

3. (1) sample

(2) statistic.

---

4. (1) quantitative

---

5. D.
Yes; it is possible to have numeric variables that do not count or measure anything, and, as a result, are qualitative rather than quantitative.

---

6. D.
Addition and subtraction of Social Security Numbers does not provide meaningful results. This makes it qualitative even though it is numeric.

---

7. (1) discrete.

---

8. A. skewed to the right

---

9. A. Neither is symmetric.

---

10. (1) continuous.

---

11. (1) qualitative

---

12. B. $\bar{x}$ = **13**

---

13. A. σ^2 = **16**

B. σ = **4**

---

14. D. $z = -0.80$

---

15. B. The student scored better on the geography test.

---

16. D. 5% of 3- to 5-month-old males have a head circumference that is 41.0 cm or less.

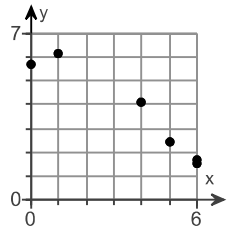
---

17. 95

0.3

16

18.

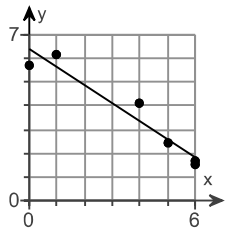


C.

(1) a linear, negative

− 0.762

6.394



B.

---

19. − 0.00761

45.4

C.

For every pound added to the weight of the car, gas mileage in the city will decrease by **0.00761** mile(s) per gallon, on average.

It is not appropriate to interpret the y-intercept.

17.432

(1) below

C. No, because the hybrid is a different type of car.

---

20. B. For each additional room in the house, we estimate the appraised value to increase $17,800

---

21. B. $R^2 = 44.89\%$

---

22. (1) coefficient of determination,

---

23. 80.5

A.

R^2 of the variation in head circumference is explained by the least-squares regression equation. The linear model appears to be appropriate.

---

24. R^2

---

25. A.
The correlation coefficient is a measure that describes the direction and strength of the linear relationship between two quantitative variables.

---

26. B.
The relationship between the two variables and if there are any deviations from the pattern (outliers or clusters of points, for example).

---

27. III

---

28. D. Yes, because the probabilities sum to 1 and they are all greater than or equal to 0 and less than or equal to 1.

A. Impossible event

---

29. 0.70

---

30. (1) P(E) + P(F).

---

31. 0.264

0.380

No, less likely

---

32. A. No, because the sum of the probabilities is not equal to 1.

---

33. 0.67

---

34. 0.18

---

35. A. The random variable is discrete. The possible values are $x = 0, 1, 2, \ldots$.

D. The random variable is continuous. The possible values are $r \geq 0$.

---

36. 0.19

---

37. D. No, because the sum of the probabilities is not equal to 1.

---

38. A. The experiment is performed a fixed number of times., B. There are two mutually exclusive outcomes, success or failure., E. The trials are independent., F. The probability of success is the same for each trial of the experiment.

---

39. 0.9294

---

40. 0.1655

0.9004

(1) Yes,

(2) would

0.0272

(3) less than

---

41. 60

4.9

B. It is expected that in a random sample of 100 adult smokers, 60 will have started smoking before turning 18.

---

42. 0.0476

---

43. 0.2539

---

44. 240

6.9

C. It is expected that in a random sample of 300 adult smokers, 240 will have started smoking before turning 18.

C. Yes, because 255 is greater than $\mu + 2\sigma$.

---

45. A. The area under the normal curve to the right of the mean is 0.5. , D. The high point is located at the value of the mean., F. The graph of a normal curve is symmetric.

---

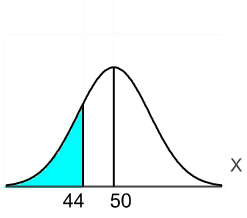
46. 0.1957

0.0228

0.3735

0.0008

47.



C.

0.1957

---

48. 0.8490

0.1624

0.6566

6

---

49. 36.94

    24

---

50. C. $\mu_{\bar{x}} = 40.000$, $\sigma_{\bar{x}} = 5.000$

---

51. B. The distribution is approximately normal.

    85

    1

    0.0256

    0.0062

    0.8387

---

52. C. The sampling distribution of $\bar{x}$ is approximately normal because the sample size is large enough.

    3

    0.274

    0.1367

    A. This result is not unusual because its probability is large.

    C. Since this result is not unusual, it is not reasonable to conclude that the population mean is higher than 3.

---

53. C. A confidence interval for a population mean gives possible values the true population mean will be with a certain level of confidence.

---

54. A.
    A confidence interval is a range of values used to estimate the true value of a population parameter. The confidence level is the probability the interval actually contains the population parameter, assuming that the estimation process is repeated a large number of times.

---

55. A. margin of error

---

56. C. Increase the level of confidence

---

57. A. 7.5 mm

---

58. E.
    We are 99% sure that the average amount of time spent studying among graduate students at this student's school is between 17.3 and 22.5 hours per week.

---

59. A. 4 hours/week

---

60. B. The width of the confidence interval would be smaller.

---

61. (1) half

---

62. 0.741

0.859

---

63. 0.595

0.164

714

---

64. (1) We are 90% confident

(2) registered voters

0.406

0.456

---

65. D. 0.206

---

66. C. 0.5500 ± 0.0154

---

67. C. 419

---

68. 16.72

19.88

17.12

19.48

A. The margin of error decreases.

16.18

20.42

C. The margin of error increases.

A. The sample data must come from a population that is normally distributed with no outliers.

---

69. 192

111

C. Decreasing the confidence level decreases the sample size needed.

---

70. 2398

2401

A. The results are close because $0.52(1 - 0.52) = 0.2496$ is very close to 0.25.

---

71. 363

385

---

72. D. H_0: p = 0.5, where p = the proportion of all adults in this city rooting for North High School

---

73. B. H_1: p > 0.5, where p = the proportion of all adults in this city rooting for North High School

---

74. B.
A p-value is the probability of observing the actual result, a sample mean, for example, or something more unusual just by chance if the null hypothesis is true.

---

75. (1) II

---

76. A. The probability of making a type I error is 0.05.

---

77. A. The mean price of a single family home in the broker's neighborhood is $243,767.

A. The mean price of a single family home in the broker's neighborhood is greater than $243,767.

(1) μ

(2) =

243,767

(3) μ

(4) >

243,767

(5) rejects

(6) equal to

243,767

(7) equal to

243,767

(8) fails to reject

(9) equal to

243,767

(10) greater than

243,767

---

78. A.
There is not sufficient evidence to conclude that the standard deviation of monthly cell phone bills is less than its level three years ago of $49.18.

---

79. B.
There is not sufficient evidence to conclude that the mean price of a single-family home has decreased from its level two years ago of $299,800.

---

80. (1) p

(2) =

0.099

(3) p

(4) >

0.099

A.
There is not sufficient evidence to conclude that the proportion of high school students exceeds 0.099 at this counselor's high school.

B.
A Type II error was committed because the sample evidence led the counselor to conclude the proportion of e-cig users was 0.099, when, in fact, the proportion is higher.

---

81. (1) a p-value.

---

82. 0.1834

C. Since P-value > α, do not reject the null hypothesis

---

83. (1) =

0.017

(2) >

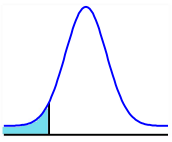
0.017

0.114

D.
Since P-value > α, do not reject the null hypothesis and conclude that there is not sufficient evidence that more than 1.7% of the users experience flulike symptoms.

---

84. − 1.80



A.

A. 0.025 < P-value < 0.05

A. The researcher will reject the null hypothesis since the P-value is less than α.

---

85. Yes

0.003

(1) Reject

(2) less

---

86. F. H_0: $\mu = 63.7$ in. versus H_1: $\mu > 63.7$ in.

B.
There is a 0.02 probability of obtaining a sample mean height of 64.2 inches or taller from a population whose mean height is 63.7 inches.

B.
Reject the null hypothesis. There is sufficient evidence to conclude that the mean height of women 20 years of age or older is greater today.

---

87. B. H_0: $p_1 = p_2$ versus H_1: $p_1 \neq p_2$

-0.58

0.562

C. Do not reject the null hypothesis because there is not sufficient evidence to conclude that $p_1 \neq p_2$.

---

88. D. $(-0.141, 0.208)$

---

89. B. H_0: $p_1 = p_2$ versus H_1: $p_1 \neq p_2$

-0.35

0.729

A. Do not reject the null hypothesis because there is not sufficient evidence to conclude that $p_1 \neq p_2$.

---

90. 0.310

0.366

B.
There is 90% confidence that the difference in the proportion of adult Americans from 2003 to 2008 who believe the United States made the right decision to use military force in the country is between the lower and upper bounds of the interval.

---

91. F. H_0: $\mu_d = 0 H_1$: $\mu_d > 0$

3.41

0.002

B. Reject H_0. There is sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that the difference is greater than 0.

E. There is sufficient evidence that babies have the ability to assess surprising behavior.

---

92. A. The sample size is no more than 5% of the population size., D. The sampling method results in a dependent sample., E. The differences are normally distributed or the sample size is large.

(1) $\mu_d = 0$

(2) $\mu_d < 0$

-0.03

0.489

(3) Do not reject

(4) greater than

(5) is not

(6) are taller than

---

93. A. Using the same dates makes the second sample dependent on the first and reduces variability in water clarity attributable to date.

(1) =

0

(2) <

0

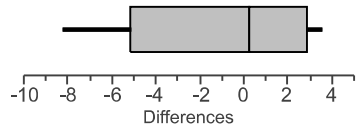
-0.54

-2.02

(3) Do not reject

(4) is not

B.



A. Yes, because 0 is contained in the boxplot.

---

94. C. $H_0: \mu_1 = \mu_2$, $H_1: \mu_1 \neq \mu_2$

2.21

B. $0.01 \leq$ P-value < 0.05

(1) Reject

(2) less than

0.25

6.35

---

95. C. $H_0: \mu_1 = \mu_2 H_1: \mu_1 \neq \mu_2$

0.129

B. Do not reject H_0, there is not sufficient evidence to conclude that the two populations have different means.

-0.60

4.40

---

96. B. (0.487, 3.513)

---

97. B. $H_0: \mu_1 = \mu_2 H_1: \mu_1 > \mu_2$

0.040

D.
Do not reject H_0. There is not significant evidence at the $\alpha = 0.01$ level of significance to conclude that carpeted rooms have more bacteria than uncarpeted rooms.

---

98. (1) $\mu_S - \mu_P$

(2) =

0

(3) $\mu_S - \mu_P$

(4) ≠

0

1.02

0.31

31

(5) the same

(6) is not

(7) do not

(8) is not

(9) different from

(10) μ_D

(11) =

0

(12) μ_D

(13) ≠

0

3.21

0.00

(14) is

(15) do

(16) is

(17) different from

7.50

7.50

2.55

2.34

(18) the same.

(19) greater than
