

1. The width of a confidence interval is
  - A. four times half the margin of error.
  - B. two times half the margin of error.
  - C. the margin of error.
  - D. half the margin of error.
  - E. two times twice the margin of error.
  
2. Each time you play a game, you lose with probability 0.4. Assuming the outcomes are independent, what is the expected number of plays required until you win?
  - A. 5.2
  - B. 0.4
  - C. 2.5
  - D. 0.6
  - E.  $5/3$
  
3. The population of North America is 520 million, and the number of North Americans with HIV is 1.5 million. If a North American does not have HIV, a test will indicate the person does have HIV with probability 0.01. If a North American does have HIV, the test will indicate this with probability 0.98. If a test indicates a person does not have HIV, what is the chance that the person does not have HIV?
  - A. 0.99000
  - B. 0.98500
  - C. 0.99994
  - D. 0.98000
  - E. 0.97727
  
4. Your boss wants a 95% confidence interval for the mean lifetime of a bacteria colony with a margin of error no larger than 2 hours. What is the minimum number of colonies you must observe if the lifetime has standard deviation of three hours?
  - A. 6
  - B. 7
  - C. 8
  - D. 9
  - E. not enough information is given.

5. A sample of twenty two people from a normally distributed population with incomes below the poverty level yields an average daily calcium intake of 755 mg and sample standard deviation of 143 mg. The U.S. recommended daily allowance of calcium is 800 mg. Which of the following statements is most appropriate?
- At the 5% level of significance, reject the claim that people below the poverty level are getting enough calcium.
  - At the 6% level of significance, reject the claim that people below the poverty level are getting enough calcium.
  - At the 7% level of significance, fail to reject the claim that people below the poverty level are getting enough calcium.
  - At the 8% level of significance, reject the claim that people below the poverty level are getting enough calcium.
  - None of the above statements are appropriate.
6. What is the minimum sample size required to obtain a 98% confidence interval for a proportion with a margin of error of 0.01?
- 10545
  - 59
  - 13,530
  - Not enough information is given.
  - 10544.71
7. Tennessee license plates have three English letters followed by three one-digit numbers from  $\{0, 1, \dots, 9\}$ . If there are twenty three-letter words and ten three-digit numbers that cannot be used on any plate, how many different license plates can be made?
- 17,576,000
  - 11,232,000
  - 17,380,240
  - 11,231,970
  - 17,380,440
8. Below are data on classroom temperature vs. average exam score:

temp ( $^{\circ}\text{F}$ )	68	72	75	80
average exam score (%)	85	80	78	73

Use these data to predict the average exam score when the classroom temperature is  $70^{\circ}\text{F}$ .

- 82.66
- 10.574
- 82.87
- 10.766
- 82.13

9. Given a random variable with mean  $100^{\circ}\text{F}$  and standard deviation  $5^{\circ}\text{F}$ , what is the approximate probability that the mean of a sample of size 150 will exceed  $101^{\circ}\text{F}$ ?
- A. 0.0072
  - B. 0.9928
  - C. 0.0050
  - D. 0.5
  - E. 0.4207
10. Kyle misses 20% of his shots from the free throw line. In twenty independent shots, what is the probability that he makes no more than fifteen?
- A. 0.1958
  - B. 0.6296
  - C. approximately 1
  - D. 0.3704
  - E. 0.1746
11. Which of the following is not true?
- A. There are ten deciles.
  - B. There are ninety nine percentiles.
  - C. There are three quartiles.
  - D. 60% of the data values are below the sixtieth percentile.
  - E. Approximately 4.55% of observations from a normal population are farther than two standard deviations from the mean.
12. A population of students consists of 500 freshmen, 400 sophomores, 400 juniors, and 300 seniors. A stratified sample of 64 students is to be chosen with proportional allocation from each class. How many freshmen should be included in the sample?
- A. 16
  - B. 20
  - C. 24
  - D. 22
  - E. 30

13. Organizers of a raffle will sell 1000 tickets for \$2 each. They will then select two tickets at random. The holder of the first ticket will win \$100 and the holder of the second ticket will win \$50. What is Tom's expected net gain if he buys one ticket?
- A. \$1.85
  - B. \$-0.15
  - C. \$0.10
  - D. \$0.15
  - E. -\$1.85
14. If  $X$  represents Tom's net gain in the previous problem, what is the variance of  $X$ ?
- A. 15.90 dollars
  - B. 15.90 square dollars
  - C. 12.48 dollars
  - D. 12.48 square dollars
  - E. 7.92 square dollars
15. The weekly demand for shrimp at a seafood counter is distributed approximately normal with mean 400 lbs. and standard deviation 40 lbs. What is the minimum amount of shrimp the manager should order so there will be at least a 98% chance that there will be enough?
- A. 400 lbs.
  - B. 481 lbs.
  - C. 482 lbs.
  - D. 483 lbs.
  - E. 484 lbs.
16. The least-squares regression line for a set of data points has which of the following properties?
- A. It passes through  $(\bar{x}, \bar{y})$  where  $\bar{x}$  and  $\bar{y}$  are the respective mean of the  $x$  and  $y$  coordinates of the data points.
  - B. It is the line for which the sum of squared residuals is minimized.
  - C. The sum of the residuals is 0.
  - D. All the above are true.
  - E. Only A and B are true.

17. Given the set of numbers  $x_1, x_2, \dots, x_n$ , let  $\sigma$  and  $s$  denote the standard deviations of  $x_1, x_2, \dots, x_n$  computed by viewing the numbers as a population and a sample, respectively.

I  $\sigma < s$

II On the average, the mean of a sample is the population mean.

III On the average, the sample standard deviation of a sample is the population standard deviation.

Which is/are true?

A. I and II only

B. II and III only

C. I, II, and III

D. I only

E. III only

18. The least-squares regression line for a set of data is  $y = 3x + 5$ . A particular data point has  $x$ -coordinate 1.5 and its residual is -3. Then its  $y$ -coordinate is

A. 12.00

B. 12.50

C. 6.50

D. 4.50

E. 9.50

19. A woman tells you she has exactly two children, at least one of whom is a boy. What are the odds that she has a daughter?

A. 1:1

B. 2:1

C. 1:2

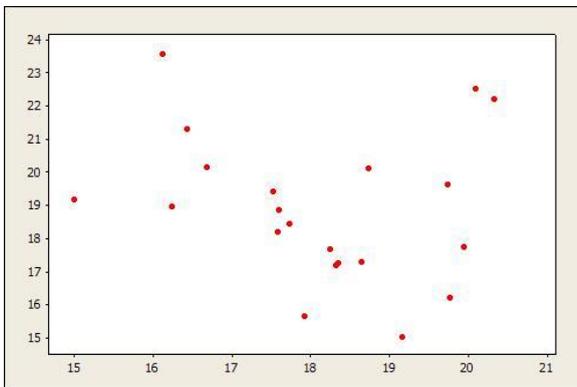
D. 1:3

E. 3:1

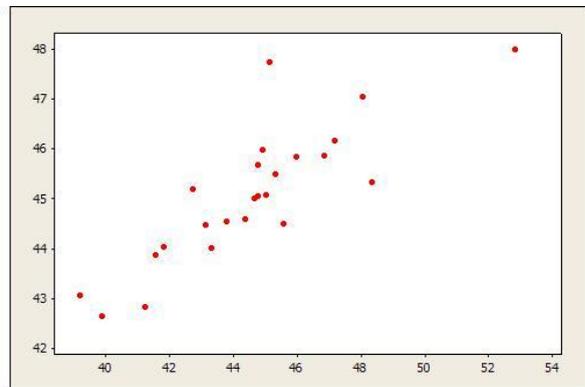
20. Which of the following is not true?

- A. The probability of a type I error is denoted by  $\alpha$ .
- B. The probability of a type II error is denoted by  $\beta$ .
- C. If we reject the null hypothesis when it is true, we are committing a type I error.
- D. It is more significant to reject the null hypothesis at the 5% level of significance than at the 1% level.
- E. All of the above are true.

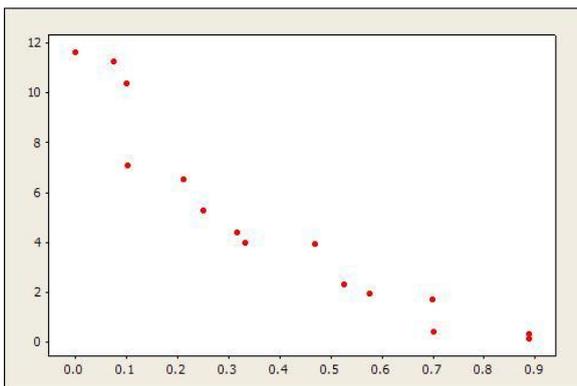
21. Match the following  $r$ -values with the corresponding scatterplots.



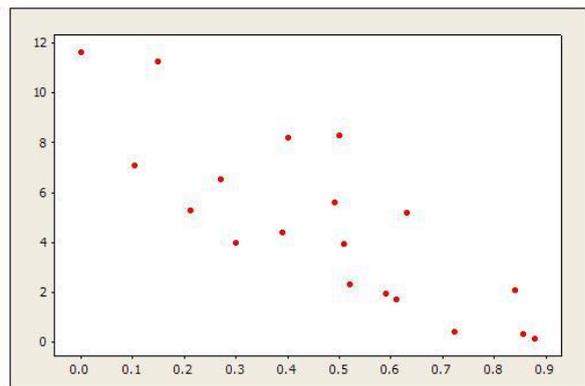
**a**



**b**



**c**



**d**

- A. (a) 0.170, (b) 0.843, (c) -0.932, (d) -0.823
- B. (a) 0.843, (b) 0.170, (c) -0.932, (d) -0.823
- C. (a) -0.932, (b) -0.823, (c) 0.170, (d) 0.843
- D. (a) 0.170 (b) 0.843, (c) -0.823, (d) -0.932
- E. (a) 0.843 (b) 0.170, (c) -0.823, (d) -0.932

22. Which of the following statements is/are true?

- I. Half the people are below average.
- II. Half the people are above the median.
- III. Most of the people are at the mode.
- IV. The mean and median are always within one standard deviation.

- A. I only
- B. II only
- C. I and III
- D. I and II
- E. II and IV

23. A city has four fire districts. The data below are the frequencies of fires in each district for a random sample of 100 fires. The Chi-square goodness of fit test is used to determine if the fires are distributed equally in the four districts. Give the Chi-square value for the sample data.

District	1	2	3	4
Number of Fires	20	25	30	25

- A. 2
- B. 10
- C. 1
- D. 3
- E. 4

24. The power of a hypothesis test is

- A. the probability that we reject the null hypothesis when the alternate hypothesis is true.
- B. the probability that we accept the null hypothesis when the alternate hypothesis is true.
- C. the probability that we reject the null hypothesis when the null hypothesis is true.
- D. the probability that we accept the null hypothesis when the null hypothesis is true.
- E. the probability that we reject the null hypothesis when the alternate hypothesis is false.

25. In which of the following cases would it be appropriate to use the paired sample  $t$ -test to compare the mean scores of husbands and their wives on an aptitude test?
- We have the scores of independent samples of 40 married men and 30 married women on the exam.
  - We have the scores of a random sample of 40 married couples on the exam.
  - We have the scores of independent samples of 40 married men and 40 married women on the exam.
  - We have the exam scores of 40 married couples where both are teachers in the local school system.
  - We have the scores of a random sample of 40 married male school teachers and an independent random sample of 40 married female school teachers.
26. Which of the following situations is not appropriate for applying the binomial distribution?
- Tossing a fair coin 20 times and finding the probability of 12 heads in the 20 tosses
  - Choosing 20 chips, with replacement, from a bowl containing 7 blue chips and 3 red chips and finding the probability that 20 of the chips are blue
  - Choosing 20 chips, without replacement, from a bowl containing 7 blue chips and 3 red chips and finding the probability that 20 of the chips are blue
  - Finding the probability that 12 of 20 randomly selected patients will respond favorably to a treatment that is known to have a success rate of 70%
  - Rolling a fair die 20 times and finding the probability that 5 of the rolls are sixes
27. A random sample of 500 voters is polled to determine their views on a bond issue and their political party. The results are given in the contingency table below. Assuming that views on the bond issue are independent of party affiliation, how many of the voters would we expect to be Democrats against the bond issue?

Party	For	Against	Undecided	Total
Republican	100	60	40	200
Democrat	140	30	10	180
Independent	40	40	40	120
Total:	280	130	90	500

- 50.2
- 30.0
- 40.5
- 46.8
- 38.6

28. At a medical clinic there are 4 male physicians whose mean salary is \$100,000 and 2 female physicians whose mean salary is \$105,000. In addition, there are 2 male nurses whose mean salary is \$40,000 and 4 female nurses whose mean salary is \$42,000. Notice that the mean salary for females is greater than the mean salary for male for both physicians and nurses. Find the mean salary for the 6 males and the mean salary for the 6 females.
- A. \$70,000 for the males and \$73,500 for the females.
  - B. \$100,000 for the males and \$105,000 for the females.
  - C. \$40,000 for the males and \$42,000 for the females.
  - D. \$71,500 for the males and \$71,500 for the females.
  - E. \$80,000 for males and \$63,000 for the females.
29. The previous problem is an example of what statistical phenomenon?
- A. The balancing property of the mean.
  - B. The Central Limit Theorem
  - C. The Law of Large Numbers
  - D. Simpson's Paradox
  - E. The Law of Statistical Diversity
30. Susie scored at the 60th percentile on an exam for which the scores had a mean of 70 and a standard deviation of 20. Her score on the exam was approximately
- A. 95
  - B. 60
  - C. 75
  - D. 83
  - E. 65
31. The previous problem is an example of what statistical phenomenon?
- A. The balancing property of the mean.
  - B. The Central Limit Theorem
  - C. The Law of Large Numbers
  - D. Simpson's Paradox
  - E. The Law of Statistical Diversity

32. For a hypothesis test the null hypothesis is  $H_0 : \mu = 80$  and the alternate hypothesis is  $H_a : \mu \neq 80$ . If the test statistic is  $z = -1.68$ , what is the  $p$ -value?
- A. 0.05
  - B. 0.0465
  - C. 0.0035
  - D. 0.0930
  - E. 0.0070
33. When doing analysis of variance to compare the means of four populations, which of the following is not true?
- A. The populations are assumed to be approximately normal with a common variance.
  - B. Increasing the variation within the samples increases the value of the  $F$ -statistic for the data.
  - C. Increasing the variation between the sample means increases the value of the  $F$ -statistic for the data.
  - D. Increasing the  $F$ -statistic for the sample data increases the likelihood of concluding that there is some difference between the population means.
  - E. The null hypothesis is that all four populations have the same mean.
34. Which of the following statements concerning the standard normal distribution and a  $t$ -distribution are true?
- I: The area to the right of  $t = 1.34$  is greater than the area to the right of  $z = 1.34$
  - II: As the number of degrees of freedom gets larger and larger, the area to the right of  $t = 1.34$  gets closer and closer to the area to the right of  $z = 1.34$
  - III: There is more area between  $t = -1.34$  and  $t = 1.34$  than there is between  $z = -1.34$  and  $z = 1.34$
- A. Just I and II are true.
  - B. All three are true.
  - C. Just I is true.
  - D. Just II and III are true.
  - E. None of them are true.

35. A lot of 5 identical electronic devices is known to contain exactly two defective devices. The devices are selected and tested one by one until both defectives are found. What is the probability that exactly four of the devices are tested?

- A.  $1/10$
- B.  $1/2$
- C.  $1/8$
- D.  $3/8$
- E.  $3/10$

36. Ninety eight of 150 men favor Brand  $X$  over brand  $Y$ , whereas 135 of 198 women favor brand  $X$  over brand  $Y$ . Let  $p_{\text{men}}$  and  $p_{\text{women}}$  denote the proportions of men and women who favor brand  $X$ . If the null and alternative hypotheses are

$$H_0 : p_{\text{men}} = p_{\text{women}}$$

$$H_a : p_{\text{men}} \neq p_{\text{women}}$$

- A. the  $p$ -value is 0.7121
- B. reject  $H_0$  at the 5% level of significance.
- C. fail to reject  $H_0$  at the 6% level of significance.
- D. the  $p$ -value is 0.2879
- E. the  $p$ -value is 0.5759

37. If  $r^2 = 0.88$  for a particular data set, which of the following statements is true?

- A. The coefficient of variation is 0.9381
- B. The correlation coefficient is 0.9381
- C. There seems to be some correlation between the variables.
- D. 88% of the variation in the independent variable is explained by the regression variable.
- E. 88% of the variation in the response variable is explained by the regression variable.

38. Coffee addicts arrive to a Starbuckaroo's coffee stand at a rate of 1 per minute. The probability that at least 2 addicts arrive in the next three minutes is

- A. 0.9502
- B. 0.8009
- C. 0.6667
- D. 0.2240
- E. none of the above.

39. In the previous problem, each addict is independently a man with probability 0.6 or a woman with probability 0.4. Of the next twelve addicts who arrive, how many do you expect to be women?
- A. 7.2000
  - B. 4.8000
  - C. 4.0000
  - D. 1.6971
  - E. none of the above.
40. The average number of ticks found on 12 tracts of land of equal size in Bounty County was 36.5 with a sample standard deviation of 21. A 98% confidence interval for the actual average number of ticks per tract is
- A. [20, 50]
  - B. [22.597, 50.803]
  - C. [22.397, 50.603]
  - D. [15.5, 57.5]
  - E. none of the above.