

1. One event has chance $1/4$, and another has chance $1/5$. If they are independent, find the probability that at least one of the two events will happen.

- (a) $1/20$
- (b) $1/5$
- (c) $2/5$
- (d) $3/5$
- (e) $9/20$

2. All carry-on bags are screened for explosives at the airport. Explosive material hidden in the baggage will trigger an alarm 99.9% of the cases, while the bags with no explosives also trigger the alarm 10% of the time. The agency estimated that 1 in 10,000 bags contains explosives. When the alarm goes off, what is the probability that the explosives can be actually found in the bag?

- (a) Less than 0.1%
- (b) 1%
- (c) 10%
- (d) 90%
- (e) More than 99%

3. A company claims that their chocolate assortments contain 10 percent dark chocolate candies. In a sample of 200 of these candies, 16 are dark chocolate candies. Which of the following statements about this study is true?

- (a) The company should change the claim to 8 percent of dark chocolate candies
- (b) The company should change the claim to “less than 10 percent” of dark chocolate candies
- (c) There is significant evidence that the percentage of dark chocolate candies is not 10%
- (d) There is not much evidence against the company’s claim
- (e) The company’s claim is correct.

4. In testing whether the true mean parameter is 85 or not, we have obtained the p-value 0.032. Which of the following statements must be true?

- (a) The null hypothesis is rejected at the significance level 0.01
- (b) The null hypothesis is not rejected at the significance level 0.05
- (c) A confidence interval is centered at 85
- (d) The 99% confidence interval contains the value 85
- (e) The 95% confidence interval contains the value 85

5. A random sample of size 9 is drawn from the normal distribution with mean 10 and standard deviation 3. What is the chance that the sample mean exceeds the value 11?
- (a) About 5%
 - (b) About 16%
 - (c) About 32%
 - (d) About 64%
 - (e) About 95%
6. The smallest and the second smallest value are considered as outliers and removed from a random sample of size 20. Which of the following statements must be true?
- (a) The sample mean will decrease
 - (b) The sample median will decrease
 - (c) Both mean and median will not change
 - (d) The standard deviation will decrease
 - (e) The first quartile will decrease
7. In a certain game, a fair die is rolled and a player wins \$12 if the die shows a **one**. Otherwise, the player loses \$3. If the player rolls 10 times, what is the expected total gain or loss for the player?
- (a) A gain of \$20
 - (b) A gain of \$5
 - (c) A loss of \$3
 - (d) A loss of \$5
 - (e) A loss of \$25
8. The weights of soldiers are normally distributed with a mean of 172 lb and a standard deviation of 30 lb, and the weights of individual combat gear are normally distributed with a mean of 76 lb and a standard deviation of 20 lb. Then the weights of the soldiers equipped with combat gear are expected to be normally distributed. What about a mean and a standard deviation for the distribution of the weights of the fully equipped soldiers?
- (a) The mean is 248 lb, and the standard deviation is about 50 lb
 - (b) The mean is 298 lb, and the standard deviation is about 50 lb
 - (c) The mean is 248 lb, and the standard deviation is about 48 lb
 - (d) The mean is 248 lb, and the standard deviation is about 36 lb
 - (e) The mean is 284 lb, and the standard deviation is about 36 lb

9. Physiologists are investigating the relationship between lean body mass (in kg) and metabolic rate (in calories per day). Based on the computer output below, which of the following is the most appropriate interpretation of the result.

Predictor	Coefficient	Standard deviation	Test statistic	P-value
Constant	264.0	276.8	0.95	0.363
Body mass	22.6	6.4	3.55	0.005

- (a) The metabolic rate increases on average by 264.0 calories per day for each additional kilogram of body mass
- (b) The metabolic rate increases on average by 22.6 calories per day for each additional kilogram of body mass
- (c) There is not enough evidence for any relationship between body mass and metabolic rate.
- (d) The body mass increases on average by 264.0 kg for each additional calorie per day for the metabolic rate
- (e) The body mass increases on average by 22.6 kg for each additional calorie per day for the metabolic rate
10. A random sample is drawn from a binomial distribution in order to test the alternative hypothesis that the proportion is greater than 0.3. Suppose that the population proportion is 0.35. In which of the following tests would the power of the test be the highest?
- (a) Sample size is 100, and the significance level is 0.01
- (b) Sample size is 100, and the significance level is 0.05
- (c) Sample size is 100, and the significance level is 0.10
- (d) Sample size is 200, and the significance level is 0.01
- (e) Sample size is 200, and the significance level is 0.10
11. A manufacturer developed a new fiber optic cable, and reported their test result on its breaking strength. According to the report, they randomly selected 20 fiber optic cables, and obtained a 95% confidence interval (434.2, 437.4) for the population mean (in pounds). Find the sample mean and the sample standard deviation.
- (a) The sample mean is about 435, and the sample standard deviation is about 3.2
- (b) The sample mean is about 435.8, and the sample standard deviation is about 3.2
- (c) The sample mean is about 435, and the sample standard deviation is about 3.4
- (d) The sample mean is about 435.8 and the sample standard deviation is about 3.4
- (e) The sample mean is about 435.8, and the sample standard deviation is about 6.8

12. A company wants to estimate the mean household income in St. Louis. Based on information from a pilot study, the company assumes that the standard deviation of household incomes is \$7200. If the company wishes to obtain an estimate within \$200 of the true mean income with 95% confidence, which of the following is the least number of households that should be surveyed.

- (a) 75 (b) 1,300 (c) 5200 (d) 5500 (e) 7700

13. A study compares the yields for two new varieties of corn, and each variety was randomly assigned to a different 1-acre plot on each of seven farms. The 1-acre plots were planted, and the corn was harvested at maturity. The table below shows the result of this study. Which of the following is the most appropriate test to see whether the two mean yields are different.

Variety	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6	Farm 7
A	48.2	44.6	49.7	40.5	54.6	47.1	51.4
B	41.5	40.1	44	41.2	49.8	41.7	46.8

(a) The sample mean yield for variety B is about 43.6, and a t-test should be used for the alternative hypothesis that the mean yield of variety A is greater than 43.6

(b) The sample mean yield for variety B is about 43.6, and a t-test should be used for the alternative hypothesis that the mean yield of variety A is not equal to 43.6

(c) The two samples are independent, and a t-test should be used for the alternative hypothesis that the mean yield of variety A is not equal to the mean yield of variety B.

(d) The two samples are dependent, and a paired t-test should be used for the alternative hypothesis that the mean difference of yields is greater than 0.

(e) The two samples are dependent, and a paired t-test should be used for the alternative hypothesis that the mean difference of yields is not equal to 0.

14. Among 104 flu patients with new influenza medicine, 57 experienced nausea as an adverse reaction. A researcher wanted to test whether the rate of nausea is higher than 50%, and calculated the test statistics $z = 0.98$. Choose the most appropriate conclusion.

(a) The p-value is 0.98, and we can support that the rate of nausea is higher than 50%.

(b) The p-value is about 0.007, and we found evidence that the rate of nausea is higher than 50%.

(c) The p-value is about 0.16, and so there is not much evidence that the nausea rate is higher than 50%.

(d) The p-value is about 0.33, and so there is not much evidence that the nausea rate is higher than 50%.

(e) 54% of the patients experienced nausea. Therefore, the test supports the hypothesis that the nausea rate is higher than 50%.

15. A tire company has been claiming that the mean lifetime for their tires is at least 40 thousand miles. An editor of a consumer magazine expressed his doubt regarding the company's claim, and decided to test the company's claim that the mean lifetime is at least 40 thousand miles. He studied 40 tires from the company, and obtained the p-value 0.02. Use the significance level 0.05, and choose the most appropriate conclusion of this study.

- (a) We can safely say that the company's claim is accurate.
- (b) The company's claim is probably correct, but further study with larger sample size should be recommended.
- (c) We can support the editor's doubt.
- (d) We cannot find evidence to support the editor's doubt.
- (e) The editor's doubt should be completely dismissed.

16. The temperatures (in degrees Fahrenheit) in 7 different cities on New Year's Day are listed below.

26 29 33 59 67 68 78

Find the median temperature.

- (a) 33
- (b) 51
- (c) 59
- (d) 67
- (e) 4

17. The weights (in ounces) of 14 different apples are shown below.

4.9 4.6 5.1 4.2 4.8 4.9 4.6 4.3 4.1 4.2 4.9 4.3 4.2 5.4

Find the mode(s).

- (a) 4.55
- (b) no mode
- (c) 4.9, 4.2
- (d) 4.9
- (e) 2

18. Elaine gets quiz grades of 71, 75, and 64. She gets a 60 on her final exam. Find the weighted mean if the quizzes each count for 20% and the final exam counts for 40% of the final grade. Round to one decimal place.

- (a) 67.5
- (b) 66.0
- (c) 68.2
- (d) 65.0
- (e) 67.3

19. The harmonic mean is often used as a measure of center for data sets consisting of rates of change, such as speeds. It is found by dividing the number of values (n) by the sum of the reciprocals of all values, expressed as

$$\frac{n}{\sum(1/x)}$$

Pierre drives to work (a distance of 58 miles) at a speed of 71 mph and returns home at a speed of 46 mph. What is his average speed for the round trip? Use the harmonic mean.

- (a) 57.1 mph
- (b) 58.5 mph
- (c) 55.8 mph
- (d) 57.5 mph
- (e) 52.5 mph

20. The test scores on the Chapter 3 mathematics test have a mean of 58 and a standard deviation of 11. Andrea scored 85 on the test. How many standard deviations from the mean is that?

- (a) 0.55 standard deviations below the mean
- (b) 0.55 standard deviations above the mean
- (c) 2.45 standard deviations below the mean
- (d) 2.45 standard deviations above the mean
- (e) 2.73 standard deviations above the mean

21. For data which are heavily skewed to the right,

- (a) The 10th percentile is likely to be closer to the median than the 90th percentile.
- (b) The 10th percentile is likely to be further away from the median than the 90th percentile.
- (c) The 10th percentile and the 90th percentile will be equally distant from the median.
- (d) The 10th percentile will always be negative since it is below the median
- (e) The 10th percentile and the 90th percentile will be the same number but have opposite signs.

22. Human body temperatures have a mean of 98.20°F and a standard deviation of 0.62°F . Sally's temperature can be described by $z = 1.4$. What is her temperature? Round your answer to the nearest hundredth.

- (a) 99.60°F (b) 100.45°F (c) 99.07°F (d) 97.33°F (e) 98.6°F

23. A spinner has equal regions numbered 1 through 21. What is the probability that the spinner will stop on an even number or a multiple of 3?

- (a) $10/9$
(b) $1/3$
(c) $2/3$
(d) 17
(e) 0

24. A sample of 100 wood and 100 graphite tennis rackets are taken from the warehouse. If 6 wood and 14 graphite are defective and one racket is randomly selected from the sample, find the probability that the racket is wood or defective.

- (a) 0.1
(b) 0.57
(c) 0.53
(d) 0.45
(e) There is insufficient information to answer the question.

25 A study conducted at a certain college shows that 55% of the school's graduates find a job in their chosen field within a year after graduation. Find the probability that among 7 randomly selected graduates, at least one finds a job in his or her chosen field within a year of graduating.

- (a) 0.985
(b) 0.550
(c) 0.143
(d) 0.996
(e) 0.050

26. The table below shows the soft drinks preferences of people in three age groups.

	cola	root beer	lemon-lime
under 21 years of age	40	25	20
between 21 and 40	35	20	30
over 40 years of age	20	30	35

If one of the 255 subjects is randomly selected, find the probability that the person is over 40 years of age given that he/she drinks root beer.

- (a) $6/17$
- (b) $2/5$
- (c) $5/17$
- (d) $3/5$
- (e) None of the above is correct.

27. Scores on a test are normally distributed with a mean of 70 and a standard deviation of 11.5. Find the 81st percentile.

- (a) 0.88
- (b) 0.291
- (c) 80.1
- (d) 73.3
- (e) 81.0

28. The systolic blood pressures of the patients at a hospital are normally distributed with a mean of 136 mm Hg and a standard deviation of 12.7 mm Hg. Find the two blood pressures having these properties: the mean is midway between them and of 90% all blood pressures are between them.

- (a) 116.1, 157.9
- (b) 115.1, 156.9
- (c) 124.6, 147.4
- (d) 119.7, 152.3
- (e) 117.2, 167.2

29. The cholesterol level in chicken eggs has a normal distribution. The mean and sample standard deviation of a simple random sample of twelve chicken eggs was 225 milligrams and 15.7 milligrams, respectively. Based on this sample, a 95% confidence interval for the mean cholesterol level of all chicken eggs is

- (a) (216.9 mg, 233.1 mg) (b) (215.1 mg, 234.9 mg) (c) (214.9 mg, 235.1 mg)
- (d) (215.0 mg, 235.0 mg) (e) (213.4 mg, 225.0 mg)

30. A simple random sample of seven students is selected, and the students are asked how much time they spent preparing for a test. The times (in hours) are as follows:

1.3, 7.2, 4.2, 12.5, 6.6, 2.5, 5.5

Based on these results, a confidence interval for the population mean is found to be (1.3163, 10.055). Find the confidence level.

- (a) 95%
- (b) 99%
- (c) 98%
- (d) 90%
- (e) 96%

31. Which of the following statements concerning the linear correlation coefficient are true?

I: If the linear correlation coefficient for two variables is zero, then there is no relationship between the variables.

II: If the slope of the regression line is negative, then the linear correlation coefficient is negative.

III: The value of the linear correlation coefficient always lies between -1 and 1.

IV: A linear correlation coefficient of 0.62 suggests a stronger linear relationship than a linear correlation coefficient of -0.82.

- (a) I and IV
- (b) I and II
- (c) II and III
- (d) III and IV
- (e) I and III

32. Choose an appropriate response regarding the value of the linear correlation coefficient r .

x	62	53	64	52	52	54	58
y	158	176	151	164	164	174	162

- (a) r will be positive but close to zero
- (b) r will be approximately $-.75$
- (c) r will be will approximately $.75$
- (d) r will be negative but closer to 0
- (e) $r = -1$

33. A bag contains green and yellow marbles. You pick two marbles out of the bag without replacing the first marble drawn. The probability that the first marble is yellow is $\frac{3}{5}$. The probability of drawing two yellow marbles is $\frac{12}{35}$. Find the probability that the second marble is yellow.

- (a) $\frac{3}{5}$
- (b) $\frac{9}{30}$
- (c) $\frac{4}{7}$
- (d) $\frac{36}{175}$
- (e) This problem is physically impossible.

34. The weight of Navy fighter pilots is normally distributed with a mean of 160 lbs. and a standard deviation of 5.5 lbs. If you randomly selected 10 Navy fighter pilots, what is the probability that 8 or more of the 10 weigh more than 162 lbs.?

- (a) 0.3594
- (b) 0.6406
- (c) 0.0057
- (d) 0.1251
- (e) 0.1867

35. What is the probability of getting four aces when dealt five cards from a regular deck of 52 cards?

- (a) $\frac{48}{2598960}$
- (b) $\frac{4}{52}$
- (c) $\frac{256}{7311616}$
- (d) $\frac{16}{208}$
- (e) $\frac{24}{6497400}$

36. There are six socks in a drawer, each of which is either black or white. You pull out two without replacement. The probability that both are white is $\frac{2}{3}$. What is the probability that both are black?

- (a) $\frac{1}{9}$
- (b) $\frac{1}{6}$
- (c) $\frac{1}{3}$
- (d) 0
- (e) $\frac{1}{36}$

37. What is the sample size necessary to find a 95% confidence interval for the proportion of drivers who are in favor of lowering the national speed limit with a margin of error of 0.05?

- (a) 10
- (b) 385
- (c) 384
- (d) 1537
- (e) 19

38. Which statement is incorrect regarding the Empirical Rule?

- (a) About 68% of data falls within 1 standard deviation of the mean
- (b) The empirical rule is based on the normal distribution
- (c) About 95% of data falls within 2 standard deviations of the mean
- (d) The empirical rule is based on the t-distribution
- (e) About 99% of data falls within 3 standard deviations of the mean

39. Which statement below is incorrect regarding the power of a hypothesis tests?

- (a) The power of a test can be increased by increasing the sample size
- (b) The power of a test is the probability of rejecting the null hypothesis when the null hypothesis is truly incorrect
- (c) The power of a test can be increased by lowering the standard deviation
- (d) The power of a test can be increased by increasing the significance level
- (e) The power of a test can be increased by decreasing the distance between the null and alternative distribution means

40. When performing the t-test, what assumptions must be made regarding the distribution of the data?

- (a) The data should come from a normal distribution.
- (b) The sample size should be relatively large.
- (c) The sample should be a simple random sample.
- (d) All of the above
- (e) In addition to (c), either (a) or (b).

41. What is the probability that it takes at least 2 rolls of a regular six-sided die to obtain a 6?

- (a) $1/6$
- (b) $1/36$
- (c) $2/6$
- (d) $5/6$
- (e) 1

42. What is the probability of getting an even product when you roll two regular four-sided dice?

- (a) $12/16$
- (b) $8/16$
- (c) $14/16$
- (d) $12/36$
- (e) $18/36$

43. Which statement is incorrect regarding confidence intervals?

- (a) The width of the confidence interval is twice its margin of error.
- (b) The margin of error increases when the confidence level increases.
- (c) The width increases when the standard deviation decreases.
- (d) The margin of error decreases when the standard deviation decreases.
- (e) The margin of error decreases when the sample increases.

44. If the number of trials, n , increases to infinity while the probability of a success, p , decreases to 0 but n times p is held constant, then the binomial distribution converges to

- (a) the normal distribution
- (b) the Poisson distribution
- (c) the binomial distribution
- (d) the t -distribution
- (e) 0 because the probability of a success is going to 0

45. Let A = patient is diagnosed with the rare disease "Iwantobeastatistician" and let B = patient truly has the disease "Iwantobeastatistician". Also, let $P(A \text{ given } B)=0.95$, $P(A \text{ given not } B)=0.05$, and $P(B)=0.1$. What is $P(B \text{ given } A)$?

- (a) 0.095
- (b) 0.1053
- (c) 0.6786

(d) 0.05

(e) 0.5263

Answers

- 1) c
- 2) a
- 3) d
- 4) d
- 5) b
- 6) d
- 7) d
- 8) d
- 9) f
- 10) e
- 11) d
- 12) c
- 13) e
- 14) c
- 15) c
- 16) c
- 17) c
- 18) b
- 19) c
- 20) d
- 21) b
- 22) c
- 23) c
- 24) b
- 25) d
- 26) b
- 27) c
- 28) b
- 29) d
- 30) c
- 31) c
- 32) b
- 33) e
- 34) c
- 35) a
- 36) e
- 37) b
- 38) d
- 39) e
- 40) a
- 41) d
- 42) a
- 43) c

44) b

45) c