

ECML 2013 Statistics

ESSEX COUNTY MATH LEAGUE
STATISTICS
MAY 22, 2013

DIRECTIONS: You may write on this test. Be sure that your name, subject, and school (including town name) are on your scantron sheet. Mark the answer sheet with dark, careful marks using a #2 pencil. Problem #21 is an open ended question and should be written on the scantron sheet separately. This question will only be used in case of a tie.

1. An eight-sided die is numbered 1-8, a twelve sided die is numbered 1-12, and a twenty-sided die is numbered 1-20. All three dice are rolled. Assuming all dice are fair, what is the probability of rolling a 5 on at least two of the dice?
A) 0.0115 B) 0.0193 C) 0.0198 D) 0.0208

2. Which one of the following distributions is not symmetrical with respect to the mean.
A) Normal B) t C) χ^2 D) Uniform
E) All are symmetrical with respect to the mean

3. A data set consists of scores with one outlier. Which of the following will change the most if the outlier is removed from the data.
A) Mean B) Median C) Mode D) Midrange

4. Which of the following are examples of a discrete random variable.
I) Shoe sizes as labeled on shoe boxes
II) The length of yarn scraps
III) The number of apples picked in an orchard
IV) The time it takes commuters to get to work
A) I,III only B) II,III only C) III only D) III,IV only E) IV only

5. A coin is tossed five times. Let H_2 be the event that heads are tossed on the second toss, T_5 be the event that tails are tossed on the fifth toss, E_1 be the event that heads are tossed on the first four tosses and tails are tossed on the fifth toss, and E_2 be the event that heads are tossed on the first toss and tails are tossed on the last four tosses. Which of the following pairs of events are mutually exclusive?

I) H_2 and T_5 II) H_2 and E_1 III) H_2 and E_2 IV) E_1 and E_2

A) I only B) II,III only C) I,III,IV only D) III only E) III,IV only

6. A recently discovered species of bats is claimed to have a mean of 510.3 grams. A random sample of 25 bats were weighed and found to have a mean of 524.7 grams and a standard deviation of 11.7 grams. A hypothesis test is conducted on the claim at the 0.05 significance level. Find the appropriate test statistic.

A) -6.15 B) -1.23 C) 1.23 D) 6.15

7. For the problem above, find the appropriate critical value(s). Note: indicate only the positive critical value if there are two.

A) 1.645 B) 1.708 C) 1.711 D) 1.960 E) 2.064

8. A given set of data has a standard deviation of 3. All the scores are multiplied by -2 and then added by 4. What is the new standard deviation?

A) -6 B) -2 C) 6 D) 10
E) Not enough information to determine

9. A fair coin and a fair die are tossed. If heads are tossed or a 3 is rolled, Tom wins \$10 from Bill. If tails are tossed and an even number is rolled, Bill wins \$20 from Tom. Otherwise, no money is exchanged. What is Tom's expectation for this game?

A) -\$2.50 B) \$0 C) \$0.83 D) \$1.67

10. The weights of widgets are normally distributed with a mean of 23.4 ounces and a standard deviation of 4.7 ounces. A random sample of widgets is chosen. What is the probability that the mean weight is less than 25.1 ounces?
- A) 0.6406 B) 0.9554 C) 0.9999 D) Not enough information
11. A cola bottling plant claims that the mean amount of cola in their twelve ounce labeled bottles is more than 11.8 ounces. A hypothesis test is conducted on the plant's claim. The company will retain its current bottle filling procedure if the claim is supported. Which of the following represents a Type I error?
- A) Retaining the bottle filling procedure when the actual mean is at most 11.8 ounces.
B) Changing the bottle filling procedure when the actual mean is not 12.0 ounces.
C) Changing the bottle filling procedure when the actual mean is more than 11.8 ounces.
D) Changing the bottle filling procedure when the actual mean is at most 11.8 ounces.
E) Retaining the bottle filling procedure when the actual mean is more than 11.8 ounces.
12. One wheel is evenly divided into three sections numbered 0,1,2. A second wheel is evenly divided into three sections numbered 1,2,3. Both wheels are spun. Let X be the product of the numbers on the wheels. Find the standard deviation of X .
- A) 0.7 B) 1.9 C) 2.8 D) 3.3
13. A fair six-sided die is rolled. If a 1 or 2 is rolled, a fair coin is flipped twice. Otherwise, a fair coin is flipped three times. Find the probability of rolling a 1 or 2 given that exactly one tail is tossed.
- A) $1/4$ B) $2/5$ C) $1/2$ D) $4/7$
14. All paired data points (x,y) satisfy the equation $2x + 3y = 36$. Which of the following is the correlation coefficient?
- A) -1 B) $-2/3$ C) 0 D) $2/3$ E) 1

15. The weight of turkeys on a poultry farm is normally distributed with a mean of 21.4 pounds. It was found that 9% of the turkeys weight more than 24.1 pounds. Find the percentage of turkeys that weigh less than 22.3 pounds.
- A) 0.6368 B) 0.6736 C) 0.8159 D) 0.9641
F) Not enough information
16. A company sells boxes of candy consisting of five flavors. A consumer group tests the claim that the proportion of flavors are equal at the 0.05 significance level by testing a random sample of 30 candies. Find the appropriate critical value for this test.
- A) 9.49 B) 11.07 C) 42.56 D) 43.77
17. A car rental agency has 225 reservations for Friday, and 190 cars available. Current studies have shown that 80% of customers keep the reservations. Use normal approximation to approximate the probability that all the customers who keep the reservations on Friday will get a car.
- A) 0.9332 B) 0.9429 C) 0.9525 D) 0.9599
18. While doing research on data, Sue calculated the mean and standard deviation of a sample to be 17.1 and 4.4, respectively. When reviewing her calculation, Sue discovered that one of the scores was erroneously recorded as 12 was really 21. Which of the following statements is true?
- A) The actual sample standard deviation is less than 4.4
B) The actual sample standard deviation is 4.4
C) The actual sample standard deviation is greater than 4.4
D) Not enough information to make one of the above conclusions.

19. Because the probability of having a positive blood test for disease H from one person is 0.001, a lab will combine 40 samples to test. If the test is negative, that means that all 40 samples are negative for disease H. Otherwise, the tests will have to be done on the individual samples. If a lab conducts such a test, what is the probability that the lab will have to test all 40 samples?
- A) 0.000761 B) 0.0250 C) 0.0384 D) 0.0392
20. A company is developing a vending machine that accepts quarters. The machine will accept a quarter provided the quarter weighs less than 5.73 grams. A study was conducted in which random samples of 50 quarters were weighed, and it was found that the probability that the mean weight of a sample is less than 5.73 grams is 0.998. Which of the following statements is not true based on the above information?
- A) The mean weight of a quarter is less than 5.73 grams.
 B) About 99.8% of quarters would be accepted by the machine than.
 C) More than half of the quarters would be accepted by the machine.
 D) It is not known what percentage of coins would be accepted by the machine.
 E) All of the statements are true.

Tie Breaker; This question will only be graded in case of a tie amongst the top scorers. It will not count towards the team score.

21. Consider the incomplete contingency table below. The numbers in the total rows or columns represent the actual total for the given row or column. The numbers in the Yes-A and No-C cells represent the expected numbers (rounded off) if the row and column variables are independent. Find the grand total.

	Yes	No	Not Sure	Total
A	103.59			x
B				263
C		164.21		315
Total	350	y	43	t