GSDMC Senior High Math Field Day - Statistics

1. The general manager of a luxury hotel decides to check the quality of housekeeping by inspecting 15 rooms. Consider that the hotel offers economy and business-class rooms as well as suites. Select the best method of sampling 15 rooms from the choices below:

   A. Take a simple random sample of 15 rooms from all rooms at the hotel.
   B. Randomly select one floor from the hotel and check the first 15 rooms
   C. Stratify according to type of room and randomly select 5 rooms from each to inspect.
   D. There are 15 suites, so select those and inspect each.

2. If an apple is hanging from a string and three flies land on it, find the probability that all three are on points that are within the same hemisphere.

   A. 4 B. 0.333 C. 0.25 D. 0.125

3. Here are the summary statistics for the monthly payroll for an accounting firm: lowest salary = \$15,000, mean salary = \$35,000, median = \$25,000, range = \$60,000, IQR = \$30,000, first quartile = \$17,500, standard deviation = \$20,000.

   Do you think the distribution of salaries is symmetric, skewed to the left, or skewed to the right?

4. Of the coffee makers sold in an appliance store, 6.0% have either a faulty switch or a defective cord, 2.0% have a faulty switch, and 0.8% have both defects. What percent of the coffee makers will have a defective cord?

   A. 4.8% B. 4% C. 6.0% D. 6.8% E. 2.8%

5. The daily high temperature for San Diego in the month of December is normally distributed with a mean of 58 degrees Fahrenheit and a standard deviation of 2 degrees Fahrenheit. What percent of high temperatures are between 56 and 62?

A. 81.5% B. 68% C. 84% D. 97.5%

6. Suppose you win a contest, and as a prize are allowed to draw, while blindfolded, 2 bills from a container. Inside the container are seven $1 dollar bills, four $10 dollar bills, and eight $20 dollar bills. What is the probability of drawing at least 1 $20 dollar bill?

A. 0.678 B. 0.515 C. 0.257 D. 0.421

7. A sample of 99 distances has a mean of 24 feet and a median of 24.5 feet. Unfortunately, it has just been discovered that an observation which was erroneously recorded as "30" actually had a value of "35". If we make this correction to the data, then:
   A. The mean remains the same, but the median is increased
   B. The mean and median remain the same
   C. The median remains the same, but the mean is increased
   D. The mean and median are both increased
   E. We do not know how the mean and median are affected without further calculations; but the standard deviation is increased.

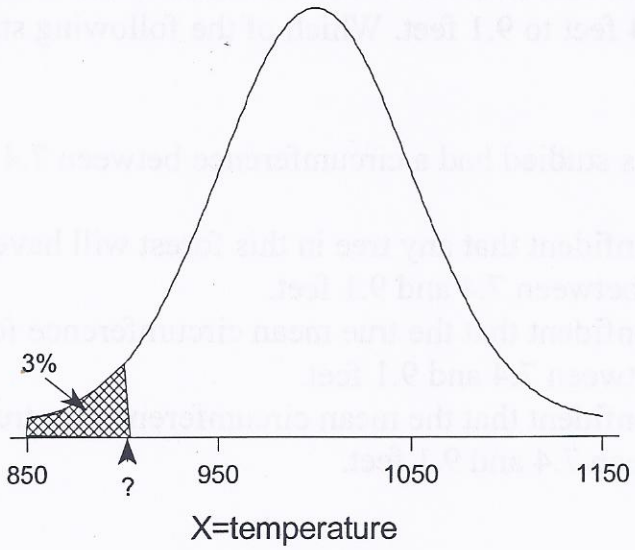
8. A newspaper article about the results of a poll states: "In theory, the results of such a poll, in 99 cases out of 100 should differ by no more than 5 percentage points in either direction from what would have been obtained by interviewing all voters in the United States." Find the sample size suggested by this statement.

A. 664 B. 385 C. 544 D. 27

9. The temperature at any random location in a kiln used in the manufacture of bricks is normally distributed with a mean of 1000°F and standard deviation of 50°F,

A. If bricks are fired at a temperature above 1125°F, they will crack and must be disposed of. If the bricks are placed randomly throughout the kiln, what proportion of bricks will crack during the firing process?

B. If the temperature is too low, the bricks discolor. Suppose you notice that 3% of all bricks discolor. Use this information to determine the temperature below which the bricks discolor.



10. A survey of students was conducted to study the relationship between the types of housing a student has and the student's mode of travel to class. The table below contains data gathered in that study.

	House	Apartment	Dorm	Total
Walk	12	44	155	211
Skateboard	26	38	108	172
Car	168	121	3	292
Total	206	203	266	675

Suppose one student is selected at random. What is the probability the student lives in an apartment or drives a car to class?

A. 0.5541 B. 0.3007 C. 0.7333 D. 0.1793

11. A 95% confidence interval for the true mean circumference of trees in a forest ranges from 7.4 feet to 9.1 feet. Which of the following statements is correct?

A. 95% of the trees studied had a circumference between 7.4 and 9.1 feet.
B. We are 95% confident that any tree in this forest will have a circumference between 7.4 and 9.1 feet.
C. We are 95% confident that the true mean circumference for trees in this forest is between 7.4 and 9.1 feet.
D. We are 95% confident that the mean circumference for trees in the sample is between 7.4 and 9.1 feet.

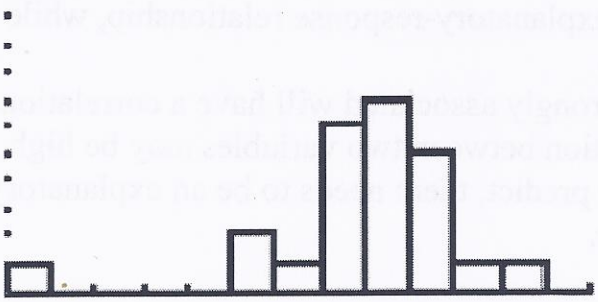
12. Real estate ads suggest that 64% of homes for sale have garages, 21% have swimming pools, and 68% have at least one of these two features. What is the probability that a home for sale has both a garage and a swimming pool?

A. 0.85 B. 0.4352 C. 0.1344 D. 0.17 E. 0.1428

13. Two friends are training for the Boston marathon. James is training on a hilly jogging loop. For the general population of runners, the time to complete this loop follows a normal distribution with a mean of 167.4 minutes and standard deviation 25.9 minutes. Rob is training on a flat jogging route. The time to complete this flat route follows a normal distribution with a mean of 143.1 minutes and standard deviation 20.7 minutes. If it takes James 91.5 minutes to complete his loop, and it takes Rob 86.2 minutes to complete his loop, who is in better condition?

A. Rob because his z-score is lower
B. James because his z-score is lower
C. Rob because his z-score is higher
D. James because his z-score is higher
E. We cannot tell from the information

14. The histogram below was generated by a statistics class. It shows the heights of a sample of freshman students.



It was determined that the outlier on the left resulted from a height being incorrectly entered. This incorrect data point was removed from the data and a new histogram was made and all new statistics were calculated. Which of the following statements is/are true?

When the incorrect data point is removed:

A. The mean and standard deviation will both be larger
B. The mean and standard deviation will both be smaller
C. The mean will be larger, but the standard deviation will be smaller
D. The mean will be smaller, but the standard deviation will be larger
E. None of the above

15. There is some evidence that drinking moderate amounts wine helps prevent heart attacks. A sample of 19 developed nations was used to investigate the relationship between yearly wine consumption (liters of alcohol from drinking wine, per person) and yearly deaths from heart disease (deaths per 100,000 people). The following results were obtained:

The regression equation is
Heart disease deaths = 240 - 19.9 Alcohol from wine
R-Squared = 51.8%

The correlation coefficient describing the relationship between alcohol consumption and heart disease deaths is:

A. 0.2683 B. 0.7197 C. -0.2683 D. -0.7197 E. -19.9

16. Which of the following statements are correct?

I Regression requires an explanatory-response relationship, while correlation does not.
II Two variables that are strongly associated will have a correlation near 1.
III Even though the correlation between two variables may be high, in order to use the LSRL to predict, there needs to be an explanatory-response relationship between x and y.

A. I and II only
B. I and III only
C. II and III only
D. I, II, and III
E. None of the above gives the complete set of true responses

17. The number of undergraduates at Johns Hopkins University is approximately 2,000, while the number at Ohio State University is approximately 40,000. At both schools a simple random sample of about 3% of the undergraduates is taken. Which of the following is the best conclusion?

A. The sample from Johns Hopkins has more sampling variability than that from Ohio State

B. The sample from Johns Hopkins has less sampling variability than that from Ohio State

C. The sample from Johns Hopkins has almost the same sampling variability as that from Ohio State

D. It is impossible to make any statement about the sampling variability of the two samples since the students surveyed were different.

E. None of the above

18. A department supervisor is considering purchasing one of two comparable photocopy machines, A or B. Machine A costs $10,000 and machine B costs $10,500. This department replaces photocopy machines every three years. The repair contract for machine A costs $50 per month and covers an unlimited number of repairs. The repair contract for machine B costs $200 per repair. Based on past performance, the distribution of the number of repairs needed over any one-year period for machine B is shown below.

Number of Repairs	0	1	2	3
Probability	.50	.25	.15	.10

You are asked to give a recommendation based on overall cost as to which machine, A or B, along with its repair contract, should be purchased. What would your recommendation be? Give a statistical justification to support your recommendation.