

University of Houston
High School Math Contest
Spring 2014
Statistics Test

Name _____

School _____

Exam Time: 1 hour

Any type of calculator is allowed. Tables are provided.

The first 15 problems are multiple choice. The last question calls for a written response. It will be used to break ties.

Name _____ School _____

Directions: Write your answers for problems 1-15 below. The tie breaker may be answered below the question. **DO NOT detach this sheet from your exam.**

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

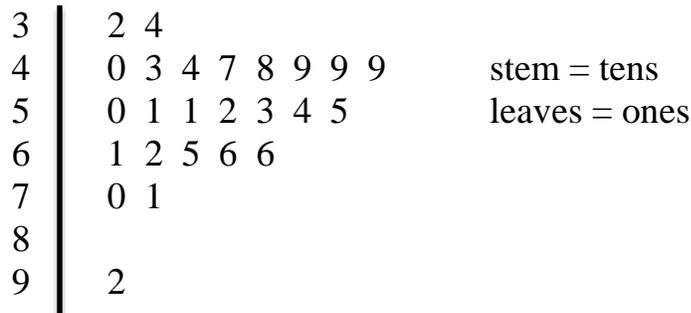
15. _____

1. The marks on a Statistics test are normally distributed with a mean of 62.5 and a variance of 187.69. If the instructor wishes to assign B's or higher to the top 25% of the students in the class, what mark is required to get a B or higher?
 - a. 68.74
 - b. 70.50
 - c. 73.24
 - d. 74.62
 - e. 71.74

2. You wish to estimate μ , the average lifetime of a particular type of battery. You are planning to select " n " batteries of this type and to operate them continuously until they fail. You have some feeling that the standard deviation of the lifetimes should be around 25 hours, and you wish your estimate of μ to be within 2 hours of μ with 95% confidence. How many batteries should you select?
 - a. 26
 - b. 27
 - c. 600
 - d. 601
 - e. 235

3. Which of the following are true statements?
 - I. The area under a density curve is always 1, regardless of mean and standard deviation.
 - II. The mean is equal to the median in a normal distribution.
 - III. The interquartile range for any normal curve extends from $\mu - 1\sigma$ to $\mu + 1\sigma$.
 - a. I and II
 - b. I and III
 - c. II and III
 - d. I, II and III

4. Scores on exams in a class can take on values of 0 to 100. Suppose the data for a recent exam in the class are represented by the following stem plot:



- The value of 92 is
- the maximum but not an outlier.
 - the maximum and an outlier.
 - one of two outliers.
 - not a data value.
 - none of these.
5. Suppose that the scatter plot of $\log Y$ on X produces a correlation close to 1. Which of the following must be true?
- The correlation between the variables X and Y will also be close to 1.
 - The residual plot of Y on X will show a clearly curved pattern of points.
 - The ratio between consecutive values of Y for equal X -intervals is approximately constant.
- I and II only
 - I and III only
 - II and III only
 - I, II, and III
 - none of these

6. At a certain gas station, 35% of the customers use regular gas, 40% use plus gas, and 25% use premium gas. Of those customers using regular gas, only 30% fill their tanks completely. Of those customers using plus, 40% fill their tanks completely, whereas of those using premium, 60% fill their tanks completely. If the next customer fills the tank, what is the probability that regular gas was requested?
- 0.2530
 - 0.4150
 - 0.1600
 - 0.1050
 - none of these
7. A manufacturer of circuits had observed that, on average, $p = 0.03$ of its circuits failed. One of the engineers suggests changes in the design to try to improve this percentage. It is decided that $n = 100$ circuits would be made using her method. The company will adopt her method if only zero or one of the circuits failed. What is the probability that the company will make a Type I error?
- 0.2641
 - 0.1946
 - 0.0476
 - 0.0300
 - none of these
8. Suppose $P(E) = 0.56$, $P(F) = 0.37$, $P(E \cup F) = 0.78$. Find $P(E^c \cup F)$.
- 0.59
 - 0.15
 - 0.22
 - 0.44
 - none of these

9. Suppose you want to play a carnival game that costs 8 dollars each time you play. If you win, you get \$100. The probability of winning is $\frac{1}{50}$. What is the expected value of the amount the carnival stands to gain?
- 6.00
 - 6.30
 - 2.00
 - 6.00
 - 5.70
 - none of these
10. The manager of a factory wants to compare the mean number of units assembled per employee in a week for two new assembly techniques. Two hundred employees from the factory are randomly selected and each is randomly assigned to one of the two techniques. After teaching 100 employees one technique and 100 employees the other technique, the manager records the number of units each of the employees assembles in one week. Which of the following would be the most appropriate inferential statistical test in this situation?
- Matched pairs t -test
 - One sample t -test
 - Two sample z -test
 - Two sample t -test
 - Chi-square goodness-of-fit test
 - none of these
11. X and Y are independent random variables. X is normally distributed with a mean of 82 and a standard deviation of 3. Y is normally distributed with a mean of 80 and a standard deviation of 5. If the values of X and Y are randomly selected, what is the probability that X is less than Y ?
- 0.6342
 - 0.3658
 - 0.0029
 - 0.8413
 - 0.1587
 - none of these

12. At Dream HS, teachers are informed that their grade distribution should model 20% A's, 30% B's, 20% C's, 15% D's, and 15% F's. Mrs. Concerned wonders if her 100 student's grades fit this pattern so she decides to perform a hypothesis test. Her students earned 26 A's, 34 B's, 30 C's, 6 D's, and 4 F's. Her test statistic is:
- less than 1
 - at least 1 but less than 10
 - at least 10 but less than 20
 - at least 20 but less than 50
 - at least 50

13. Data for gas mileage (in mpg) for different vehicles was entered into a software package and part of the ANOVA table is shown below:

Source	DF	SS	MS
Vehicle	6	412	206.00
Error	91	204	2.24
Total	97	616	

If a LSRL was fit to this data, what would the value of the coefficient of determination be?

- 66.88%
- 91.89%
- 81.78%
- 46.88%
- 33.12%
- none of the above

14. In a certain city, there are about one million eligible voters. A simple random sample of size 10,000 was chosen to study the relationship between gender and participation in the last election. The results were:

	Men	Women
Voted	2677	3533
Didn't Vote	1733	2057

If we are testing for a relationship between gender and participation in the last election, what is the p-value and decision at the 5% significance level? Select the [p-value, Decision to Reject (RH_0) or Failure to Reject (FRH_0)]

- [p-value = 0.088, RH_0]
- [p-value = 0.011, RH_0]
- [p-value = 0.005, RH_0]
- [p-value = 0.011, FRH_0]
- [p-value = 0.088, FRH_0]
- none of the above

15. An auditor for a hardware store chain wished to compare the efficiency of two different auditing techniques. To do this he selected a sample of nine store accounts and applied auditing techniques A and B to each of the nine accounts selected. The number of errors found in each of techniques A and B is listed in the table below:

Errors in A	Errors in B
45	31
48	37
46	39
48	37
52	54
50	45
49	49
40	41
45	50

Select a 90% confidence interval for the true mean difference in the two techniques.

- [3.050, 5.838]
- [-4.183, 4.183]
- [2.584, 6.304]
- [2.195, 6.693]
- [0.261, 8.627]
- none of the above

Name _____ School _____

Tie Breaker:

Sixth grade student Eric's older sister Emily is a student in their high school's AP Statistics class. Eric has been caught multiple times using his cell phone during class to play games. He is told by his parents that the next time he is caught they will take his phone away, but they have not set a number of days. Eric, who is very concerned about his phone, asks Emily how long she thinks he would be without it. As she is more familiar with her parents' inclinations in this area, she provides the following table to demonstrate the likelihoods of each possible punishment

Claim Size	20	30	40	50	60	70
Probability	0.15	0.10	0.25	0.20	0.12	0.18

Assuming that she is correct, determine the probability that Eric's actual punishment would be no more than one standard deviation from his expected punishment according to her model.