

**University of Houston**  
**High School Math Contest**  
**Spring 2013**  
**Statistics Test**

**Name** \_\_\_\_\_

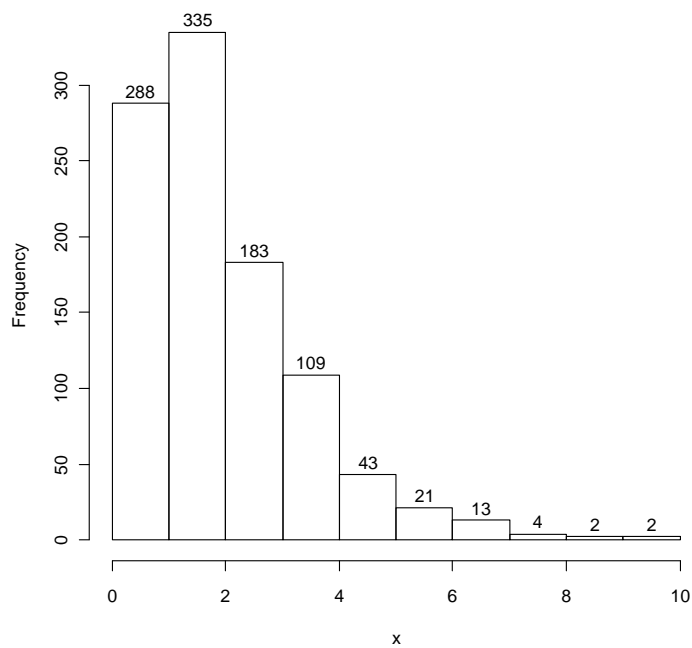
**School** \_\_\_\_\_

Exam Time: 1 hour

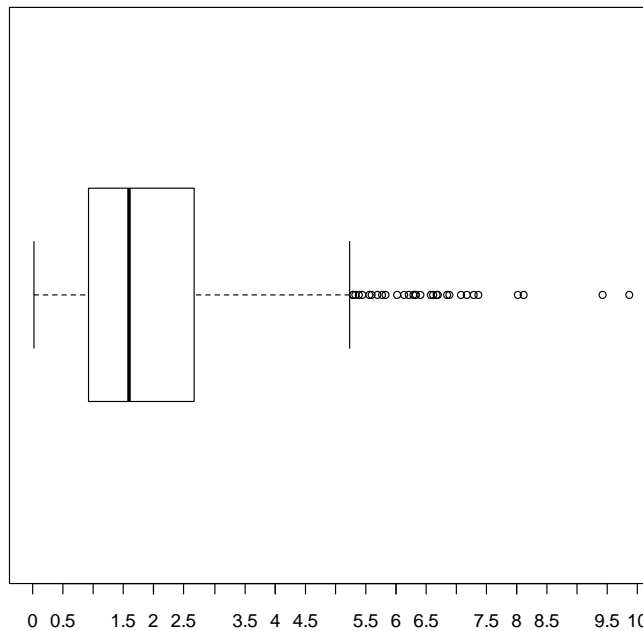
Any type of calculator is allowed. Tables are provided.

The first 15 problems are multiple choice. Each of them has only one correct answer. The last question calls for a written response. It will be used to break ties.

1. The figure below is a histogram of 1000 measurements. The heights of the histogram bars are written above them. The mean of the data is closest to
- (a) 2
  - (b) 335
  - (c) 183
  - (d) 3.5
  - (e) The distribution is not symmetric. Therefore, the mean cannot be estimated.

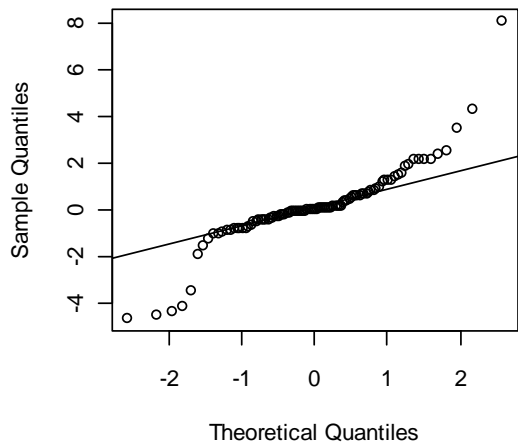


2. The figure below is a box and whisker diagram of some data. Which of the following is true?
- (a) The type of the data is nominal or categorical.
  - (b) Except for outliers, the distribution of the data is symmetric.
  - (c) A linear transformation to another scale of measurement might improve the symmetry of the data.
  - (d) At least half of the data is less than or equal to 2.
  - (e) The largest non-outlier is between 2.5 and 3.

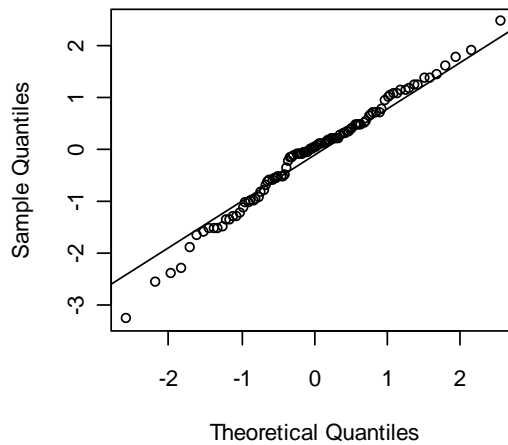


3. Which, if any, of the following normal quantile plots (also called normal probability plots) depict a sample from the same distribution that produced the box and whisker plot above?
- (a) The upper left plot
  - (b) The upper right plot
  - (c) The lower left plot
  - (d) The lower right plot
  - (e) None of them

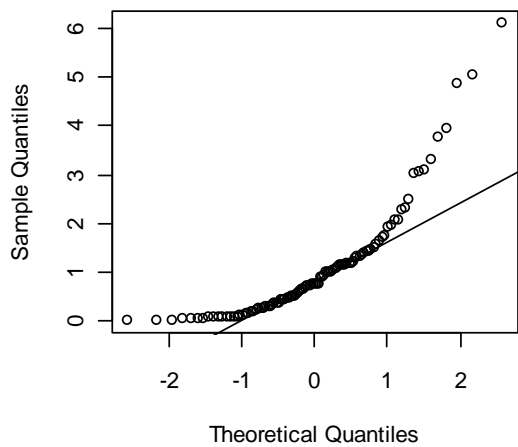
(a)



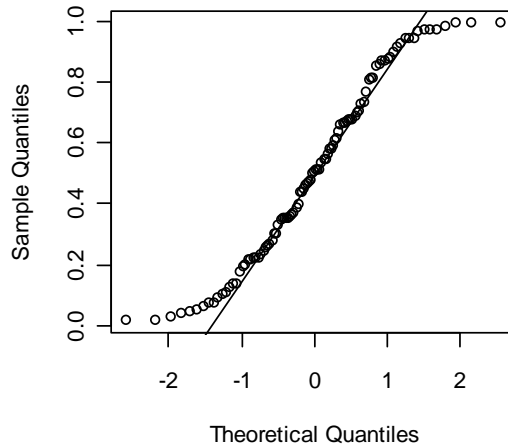
(b)



(c)



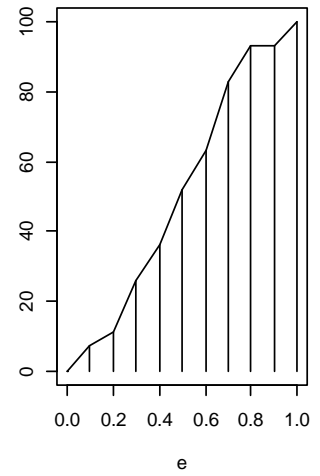
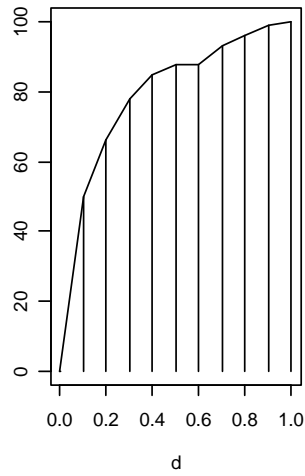
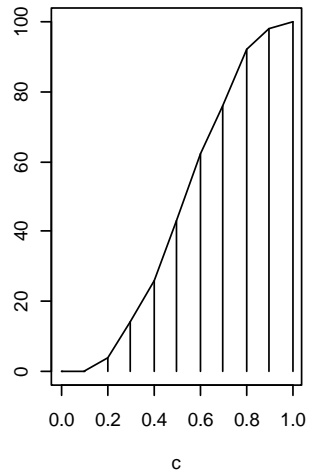
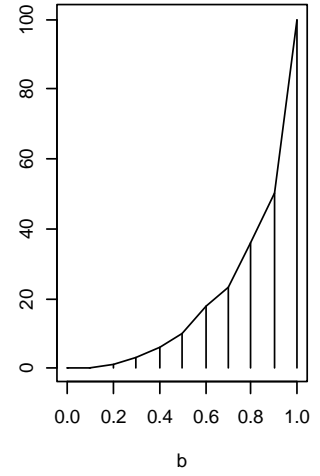
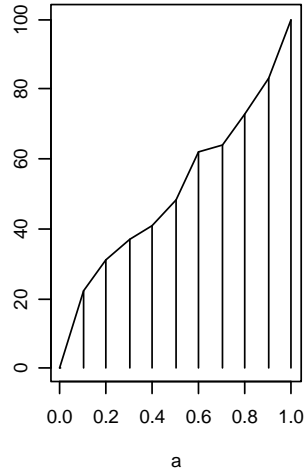
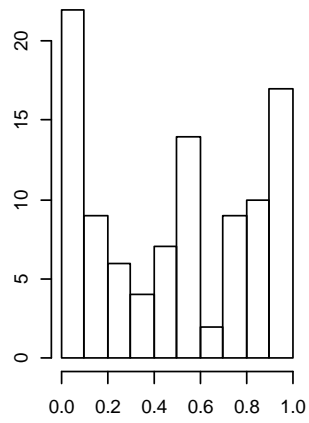
(d)



4. Scores on a national achievement test are normally distributed with a mean of 750 and a standard deviation of 100. The 90<sup>th</sup> percentile of test scores is closest to
- (a) 800
  - (b) 975
  - (c) 1050
  - (d) 875
  - (e) 785
5. Medical researchers want to estimate the mean blood glucose level of a certain population to within 5 units with 95% confidence. From previous studies it is known that the standard deviation of blood glucose levels is about 15 units. The researchers want to sample no more subjects than necessary and will assume that blood glucose levels are normally distributed. The required sample size is closest to
- (a) 35
  - (b) 115
  - (c) 62
  - (d) 933
  - (e) 640
6. Which of the following random variables could reasonably be assumed to have a binomial distribution?
- (a) The number of cars passing an intersection before a Lexus is sighted.
  - (b) The number of females in a sample of 100 high school students drawn from the greater Houston area
  - (c) The number of males in a sample of 50 members chosen without replacement from a movie theater audience.
  - (d) The number of successive random draws, with replacement, that it takes to draw 3 blue marbles from a bag. Half the marbles in the bag are blue.
  - (e) The number of fire ant mounds in a randomly chosen 1 acre plot of land.

7. The mean time to service one vehicle at an automobile service garage is 2 hours with a standard deviation of 45 minutes. What is the approximate probability that it takes more than 140 hours to service 64 vehicles?
- (a) 0.9772
  - (b) 0.0146
  - (c) 0.0228
  - (d) 0.9429
  - (e) 0.1103
8. Poll takers prior to a city-wide election conducted a survey by the following method. A random sample of 10% of the voting precincts in the city was selected. Then pollsters interviewed all registered voters in each household of the selected precincts for their preferences in the upcoming election. This is an example of
- (a) a randomized complete block design
  - (b) stratified sampling with proportional representation
  - (c) an observational study
  - (d) layered representation
  - (e) cluster sampling

9. The upper left figure is a histogram of 100 measurements. Which of the cumulative frequency plots represents the same data?

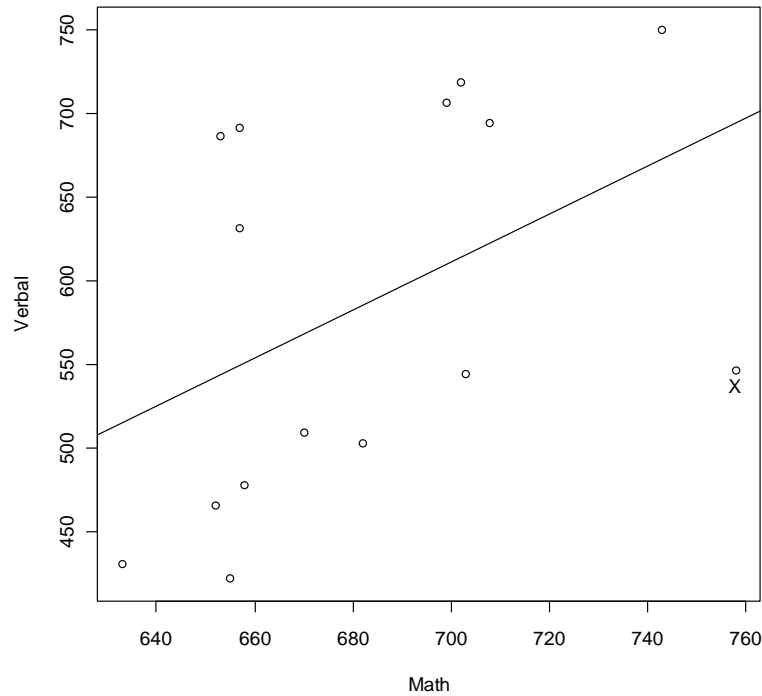


10. Colleges are classified as 4-year public, 4-year private, or 2-year. Students in a sample of 120 high school seniors were polled for the kind of institution they plan to attend, if any. The results were

4-year public	4-year private	2-year	none
31	27	42	20

- Using this data, a test is performed of the null hypothesis that these choices are equally likely against the alternative hypothesis that they are not. The null hypothesis will be rejected at a chosen significance level (probability of type 1 error) of
- (a) 20% but not 10%
  - (b) 10% but not 5%
  - (c) 5% but not 2%
  - (d) 2% but not 1%
  - (e) 1%
11. The figure below shows math and verbal scores for 15 students. Seven of them are native speakers of the language and eight are not. Which of the following is not true?
- (a) The fitted line should not be used to predict the verbal score of a student if it is known which language group the student comes from.
  - (b) The fitted line predicts a verbal score of 0 for a student whose math score is 0.
  - (c) Within limits, the fitted line could be used to predict the difference in verbal scores of two students in the same language group if the difference in their math scores is known.
  - (d) The average of the signed residuals is zero.
  - (e) The point labeled with an X is an influential observation.





12. A random sample of 36 measurements of a normally distributed variable was recorded. The sample average was 8.25 and the sample standard deviation was 1.75. A 95% confidence interval for the population mean is

- (a) from 7.66 to 8.84
- (b) from 7.76 to 8.74
- (c) from 5.29 to 11.21
- (d) from 8.17 to 8.33
- (e) from 8.20 to 9.38.

13. A pair of standard six sided dice is thrown 120 times. The total number of spots on both dice is recorded for each throw. Which of the following is closest to the probability of recording more than 25 sevens?

- (a) 0.002
- (b) 0.010
- (c) 0.150
- (d) 0.250
- (e) 0.100

14. Which of the following is not an advantage associated with stratified sampling?
- (a) Stratified sampling may result in an estimator with smaller variance than one derived from simple random sampling.
  - (b) Stratified sampling allows greater coverage of important segments of a population than simple random sampling does.
  - (c) Stratified sampling may result in more powerful hypothesis tests.
  - (d) Stratified sampling allows comparisons of estimates from different strata.
  - (e) A stratified sample can be obtained easily from a simple random sample but not vice-versa.
15. Scores on a national achievement test are normally distributed with a mean of 750 and a standard deviation of 45. A student scores 810. Which of the following is closest to her percentile score?
- (a) 85%
  - (b) 99%
  - (c) 95%
  - (d) 91%
  - (e) 88%
16. A circle is centered at the origin of coordinates and has radius  $\sqrt{6}$ . A square with sides parallel to the coordinate axes is inscribed in the circle. A projectile is fired at the center of the square. The coordinates of the impact point are independent normal random variables with mean 0 and standard deviation 1. What is the probability that the projectile lands inside the circle but outside the square?