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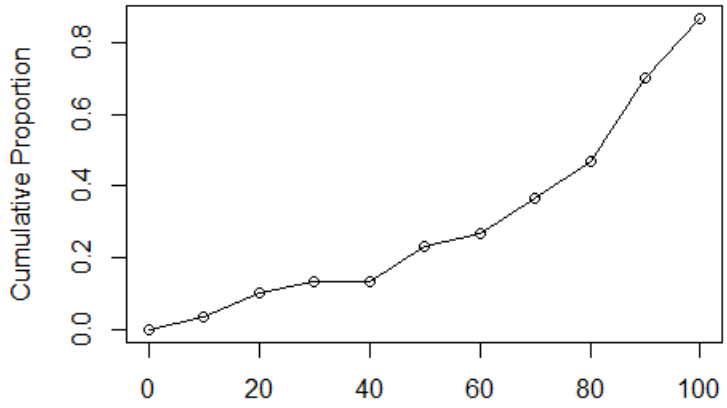
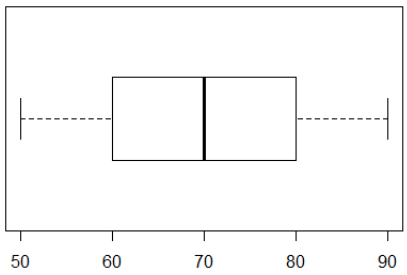
University of Houston Mathematics Contest: Statistics Exam 2017

1. The following chart is a cumulative frequency polygon of 100 observations.

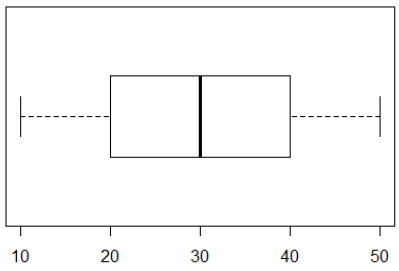


Which of the following boxplots would represent the same data?

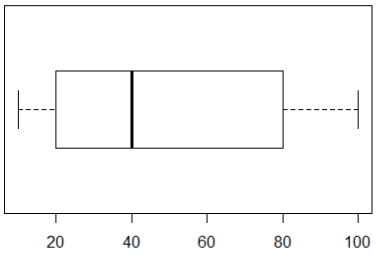
a.



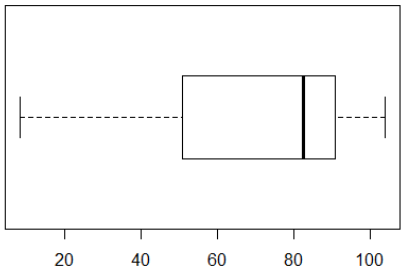
b.



c.



d.



2. The test scores for a Statistics course had a mean of 73 and a standard deviation of 16. If there was a mistake in grading the test and all the tests should have 5 more points added to the scores, what would be the new mean and the new standard deviation of the test scores?
   a. Mean = 73, standard deviation = 16
   b. Mean = 78, standard deviation = 21
   c. Mean = 78, standard deviation = 16
   d. Mean = 14.6, standard deviation = 3.2
   e. Mean = 73, standard deviation =21

3. A pool of possible jurors consists of 11 men and 13 women. How many different juries consisting of 5 women and 7 men are possible?
   a. 6
   b. 462
   c. 792
   d. 1254
   e. 424,710

4. In a batch of 8000 clock radios 7% are defective. A sample of 12 clock radios is randomly selected without replacement from the 8,000 and tested. The entire batch will be rejected if at least one of those test defective. What is the probability that the entire batch will be rejected?
   a. 0.42
   b. 0.58
   c. 0.07
   d. 0.93
   e. 0.00

5. A person must select one of three boxes, each filled with toy cars. The probability of box A being selected is 0.19, of box B being selected is 0.18, and of box C being selected is 0.63. The probability of finding a red car in box A is 0.2, in box B is 0.4, and in box C is 0.9. A box is selected. Given that the box contains a red car, what is the probability that box A was chosen?
   a. 0.133
   b. 0.038
   c. 0.056
   d. 0.190
   e. 0.677

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6. This is a standard deviation contest, which list of numbers have the largest standard deviation? No calculations are required.
   a. 10, 10, 10, 10
   b. 200, 200, 200, 200
   c. 10, 10 ,20, 20
   d. 10, 15, 15, 20
   e. They have the same standard deviation.

7. For the following probability distribution, find the expected value:

X	0	1	2	3	4
P(X = x)	$6k$	$4k$	$6k$	$3k$	$1k$

   a. 1.45
   b. 2
   c. 20
   d. 2.5
   e. 5.8

8. Which of the following are true statements?

   I. The area under the standard normal curve to the left of -3 is exactly zero.
   II. The area to the left of the median is 50%.
   III. The area under the standard normal curve between two z-scores will be negative if both z-scores are negative.

   a. I only
   b. II only
   c. III only
   d. I and II
   e. None of these.

9. The lifetime of light bulbs of a particular type are normally distributed with a mean of 293 hours and a standard deviation of 6 hours. Find the first quartile, Q_1.
   a. 73.25
   b. 291.50
   c. 297.02
   d. 288.95
   e. 294.50

10. The probability that a person has immunity to a particular disease is 0.3. From a random sample of 30 individuals, what is the probability that between 10 and 12, inclusive, people have this immunity? Choose the closest value.
    a. 0.3267
    b. 0.18516
    c. 0.1416
    d. 0.07485
    e. 0.1103

11. The probability of winning a certain lottery is 1/69,291. For people who play 689 times, find the standard deviation for the random variable X, the number of wins.
    a. 0.0997
    b. 2.6174
    c. 0.0192
    d. 0.0099
    e. 1.000

12. The monthly expenditures on food by single adults living in one neighborhood of Los Angeles has a mean of $370 and standard deviation of $80. From a random sample of 64 people, determine the probability that these people total spent more than $24,320 in one month.
    a. 0.4502
    b. 0.125
    c. 0.1587
    d. 0.8413
    e. 0.2119

13. A population of people has a mean height of 65 inches. Andrew picks a person at random from the population and records his or her height. He repeats this procedure 49 times more. Bob picks a sample of 30 people at random from the population and records the mean height of the sample. He repeats this procedure 49 times more. Which set of numbers – those recorded by Andrew or those recorded by Bob – do you think will have more variability?

    a. The numbers recorded by Andrew will have greater variability.
    b. The numbers recorded by Bob will have greater variability.
    c. The variability will be the same for both.

14. The amounts (in ounces) of juice in eight randomly selected juice bottles are:
    15.8 15.6 15.1 15.2 15.1 15.5 15.9 15.5
    Construct a 98% confidence interval for the mean amount of juice in all such bottles.

    a. (15.16, 15.76)
    b. (15.76, 15.16)
    c. (15.86, 15.06)
    d. (15.14, 15.79)
    e. (15.21, 15.71)

15. From a sample of 1,000 TV homes in the U.S., 12.3% watch Thursday night football. From this sample a 99% confidence for the percent of TV homes in the U.S. that watch Thursday night football is 12.3% ± 3%. Which of the following is the best interpretation for this confidence interval?

    a. We are 99% confident that the percent of the 1,000 TV homes in the U.S. sample that watch Thursday night football is between 9.3% and 15.3%.
    b. We are 99% confident that the percent of all TV homes in the U.S. that watch Thursday night football is 12.3%.
    c. We are 99% confident that the percent of all TV homes in the U.S. that watch Thursday night football is between 9.3% and 15.3%.
    d. There is a 99% chance that the percent of all TV homes in the U.S. that watch Thursday night football is between 9.3% and 15.3%.
    e. None of these are correct.

16. A researcher wishes to estimate the true proportion of all drivers who exceed the speed limit on a certain stretch of road where accidents frequently happen. How large should the sample be so that with 95 percent confidence, the sample proportion will not differ from the true proportion by more than 0.027?
    a. 673
    b. 36
    c. 1318
    d. 19
    e. 250

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17. Ten different families are tested for the number of gallons of water a day they use before and after viewing a conservation video. Do the data suggest that the mean amount after the view differs from the mean amount before the viewing at the 5% significance level? Give the test statistic for this test.

Before	33	33	38	33	35	35	40	40	40	31
After	34	28	25	28	35	33	31	28	35	33

a. 2.893
b. 3.087
c. 0.739
d. 0.0177
e. 1.96

18. A can of Pepsi is supposed to have a mean volume of 12 ounces. Both overfilling and underfilling are undesirable. If either occurs, the machine that fills the cans has to be readjusted. Once completing the test, they readjusted the machine but they did not have to. This is an example of:
a. Type I error
b. Type II error
c. Type III error
d. Correct decision
e. Power of the test

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19. A researcher was interested in comparing the resting pulse rate of people who exercise regularly and people who did not exercise regularly. Independent random samples of 16 people aged 30 – 40 who do not exercise regularly (sample 1) and 12 people aged 30 – 40 who do exercise regularly (sample 2) were selected and the resting pulse rate of each person what measured. The summary statistics are as follows:

Sample 1	Sample 2
$\bar{x}_1 = 72.7$	$\bar{x}_2 = 69.7$
$s_1 = 10.9$	$s_2 = 8.2$
$n_1 = 16$	$n_2 = 12$

Do the data provide sufficient evidence to conclude that the mean resting pulse rate of people who do not exercise regularly is greater than the mean resting pulse rate of people who exercise regularly? Use a significance level of 2.5%.

a. Reject H_0. At the 2.5% significance level, the data provide sufficient evidence to conclude that the mean resting pulse rate of people who do not exercise regularly is greater than the mean resting pulse rate of people who exercise regularly.
b. Do not reject H_0. At the 2.5% significance level, the data do not provide sufficient evidence to conclude that the mean resting pulse rate of people who do not exercise regularly is greater than the mean resting pulse rate of people who exercise regularly.
c. Reject H_0. At the 2.5% significance level, the data do not provide sufficient evidence to conclude that the mean resting pulse rate of people who do not exercise regularly is greater than the mean resting pulse rate of people who exercise regularly.
d. Do not reject H_0. At the 2.5% significance level, the data provide sufficient evidence to conclude that the mean resting pulse rate of people who do not exercise regularly is greater than the mean resting pulse rate of people who exercise regularly.
e. None of these are correct.

20. You wish to test the claim that a die is fair. You roll it 50 times with the following results.

Number	1	2	3	4	5	6
Frequency	5	12	11	5	9	8

Based on these numbers, what is your test statistic?

a. $t = 1.9451$
b. $z = 1.96$
c. $\chi^2 = 5.2$
d. $t = 3.394$
e. $\chi^2 = 4.8916$

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21. A distribution of grades in an introductory statistics course (where A = 4, B = 3, etc) is:

X	0	1	2	3	4
P(X)	0.11	0.18	0.2	0.32	0.19

Find the probability that a student has an A (4) given that he has passed the class with at least a C (2).

a. 0.190
b. 0.710
c. 0.950
d. 0.295
e. 0.268

22. Suppose X and Y are independent random variables. The variance of X is equal to 16; and the variance of Y is equal to 9. Let Z = X – Y, what is the standard deviation of Z?

a. 2.65
b. 5.00
c. 7.00
d. 25.0
e. It is not possible to answer this question, based on the information given.

23. Which of the following statements is true?

a. The center of a confidence interval is a population parameter.
b. The bigger the margin of error, the smaller the confidence interval.
c. The confidence interval is a type of point estimate.
d. A population mean is an example of a point estimate.
e. None of the above are true.

24. The Acme Car Company claims that at most 8% of its new cars have a manufacturing defect. A quality control inspector randomly selects 300 new cars and finds that 33 have a defect. Should she reject the 8% claim? Assume that the significance level is 0.05.

a. Yes, because the P-value is 0.016.
b. Yes, because the P-value is 0.028.
c. No, because the P-value is 0.16.
d. No, because the P-value is 0.28.
e. There is not enough information to reach a conclusion.

25. In the context of regression analysis, which of the following statements are true?

I. When the sum of the residuals is greater than zero, the model is nonlinear.
II. A random pattern in the residual plot indicates that linear regression is appropriate.
III. Influential points always reduce the correlation coefficient.

a. I only
b. II only
c. III only
d. I and II
e. I, II, and III

26. A survey was conducted on local restaurants based on the quality of their service. Customers rated the restaurants on a scale from 0 (terrible) to 100 (excellent). Use the five number summary for the data given below to determine if there are any outliers.

MIN	Q1	MEDIAN	Q3	MAX
15	54	72	78	99

a. There are no outliers for this data.
b. There are outliers near and including the minimum value.
c. There are outliers near and including the maximum value.
d. There are outliers near and including both the minimum and maximum values.
e. There is not enough information given to determine if there are outliers.

27. Mrs. Finsky and Mr. McDoodle both teach chemistry. They are arguing over whose students have less variation in their exam grades. Mrs. Finsky grades his exams on a 40 point scale and Mr. McDoodle uses a 100 point scale. Information about their class grades is given below. Whose class has the least variability?

	Finsky	McDoodle
Class size	39	38
Exam mean	31	74
Exam standard deviation	2.8	3.2

a. Mr. McDoodle's class.
b. Mrs. Finsky's class.
c. They have the same variability.
d. It is impossible to tell with the given information.

28. If a set of data has an exponential relationship, then a scatter plot of ____ will be linear.
    a. y on $\log x$
    b. $\log y$ on $\log x$
    c. $\sqrt{y}$ on x
    d. $\log y$ on x
    e. y on $\sqrt{x}$

29. Given a data set consisting of 33 unique whole number observations, its five-number summary is:

MIN	Q1	MEDIAN	Q3	MAX
13	24	38	51	69

    How many observations are strictly less than 24?
    a. 7
    b. 9
    c. 23
    d. 8
    e. 6

30. A two-way table relates the favored country of origin of car manufacturer and the household income of a set of 200 respondents of a survey. If a chi-square test of independence indicates a significant result, which of the following is not a valid fact about the test?

    a. The null hypothesis of the test is that the variables are independent.
    b. The chi-square test is, by definition, one-tailed.
    c. The degrees of freedom of the test is found by multiplying the number of rows of the table to the number of columns of the table.
    d. The calculated value of chi-square must exceed the critical value of the chi-square distribution of the appropriate number of degrees of freedom.