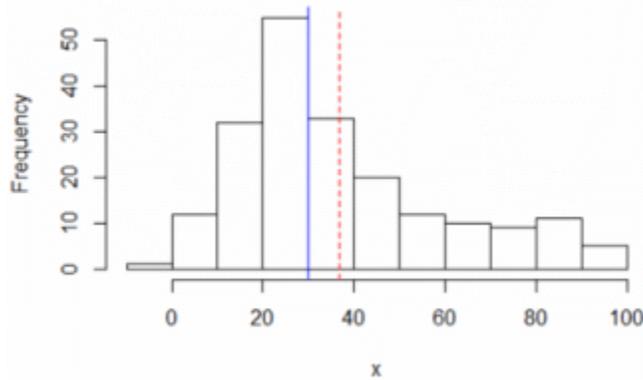


Statistics Exam - University of Houston Math Contest January 30, 2021

1) The following chart is a histogram of data values where a red dotted line is at 37 and a blue solid line is at 30. One of these vertical lines is at the mean and the other is at the median. Which statement is true?



- a) The mean and median is 30.
- b) The mean and median is 37.
- c) The mean is 37 and the median is 30.
- d) The median is 37 and the mean is 30.
- e) None of these statements are true.

2) Fifty people were asked what is their favorite ice cream and their favorite ice cream cone. The following table is the result of the survey.

		Ice Cream Favorite		
		Chocolate	Strawberry	Vanilla
Cone Favorite	Cake	1	1	5
	Sugar	6	5	19
	Waffle	2	3	8

What proportion of the people that said vanilla ice cream was their favorite also found the waffle cone to be their favorite ice cream cone?

- a) 0.25
- b) 0.16
- c) 0.64
- d) 0.615
- e) 0.26

3) If we choose a simple random sample (SRS) from a population, we can be sure that the _____ which we compute from our SRS is a/an _____ estimate of the population's true _____. We also know that we can reduce the _____ of our result as desired by taking a large enough sample. The appropriate sequence of words to complete this statement is

- a) Parameter, variation, statistic, unbiasedness
- b) Parameter, unbiased, statistic, variation
- c) Statistic, variation, parameter, unbiasedness
- d) Variation, parameter, statistic, unbiased
- e) Statistic, unbiased, parameter, variation

4) A survey finds that 30% out of 1500 people interviewed do not approve of capital punishment. The number 30% is

- a) a variance. b) a parameter. c) a statistic. d) a confidence level. e) a random digit.

5) A survey is conducted by selecting a sample of counties from 3000 counties in the country. The counties are divided into urban, rural, and suburban; a separate sample is chosen at random from each group. The survey is a

- a) stratified random sample. b) simple random sample. c) systematic random sample.
d) biased response sample. e) voluntary response sample.

6) You have data on returns on common stocks for all years since 2000. To show clearly how returns have changed over time, your best choice of graph is

- a) a scatterplot b) a pie chart c) a bar graph d) a histogram e) a line graph

7) Heights of a child and father are measured in inches. What are the units of the mean, the median, the quartiles, the standard deviation, and the correlation between the height of a child and their father?

- a) All are measured in inches except the correlation, which is measured in percent.
b) All are measured in inches.
c) All are measured in inches except the correlation, which is measured in squared inches.
d) All are measured in inches except the correlation, which is a number that has no units.
e) All are measured in inches except the standard deviation, which is measured in squared inches.

8) The following is a stem-plot of the birth weights of a random sample of male babies born to mothers that smoke. The stems are in units of kg.

Stems	Leaves
2	3,4,6,7,7,8,8,8,9
3	2,2,3,4,6,7,8,9
4	1,2,2,3,4,5,6
5	3,5,5,6

Find the median birth weight.

- a) 43.25 b) 28 c) 37.25 d) 23 e) 36.5

9) 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) 10, 10, 20, 20 c) 200, 200, 200, 200
d) 10, 15, 15, 20 e) They have the same standard deviation.

10) 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 2 more points added to the scores, what would be the new mean and the new standard deviation of the test scores?

- a) Mean = 77, standard deviation = 20
- b) Mean = 73, standard deviation = 20
- c) Mean = 73, standard deviation = 16
- d) Mean = 75, standard deviation = 18
- e) Mean = 75, standard deviation = 16

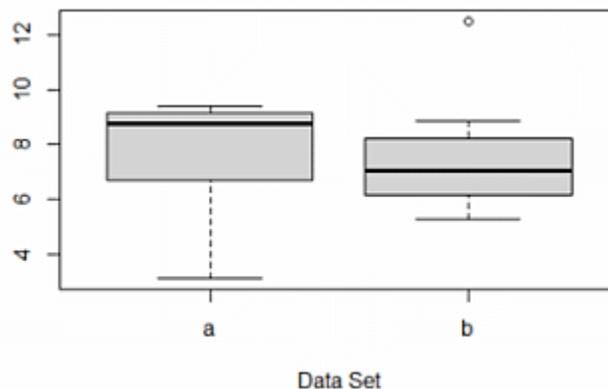
11) Which of the following terms refers to the possible values of a random variable and the probability of the values?

- a) Independence
- b) Statistic
- c) Degrees of freedom
- d) Population
- e) Probability distribution

12) A pool of possible jurors consists of 10 men and 15 women. How many different ways can we select a jury of 12 people with the same amount of men and women?

- a) 87,587
- b) 12
- c) 150
- d) 1,051,050
- e) 36

13) The following graph is a box plot of two data sets, a and b. Which statement is false?



- a) 50% of the values in data set b is between approximately 6 and 8.
- b) Data set b has more values.
- c) The median for data set a is higher than the median for data set b.
- d) Data set a is skewed left.
- e) Data set b has an outlier.

14) Which of the following is not affected by an extreme value in a data set?

- a) Mean
- b) Standard deviation
- c) Correlation
- d) Median
- e) Range

15) You calculate that a standard deviation of a set of observations is zero. This tells you that

- a) you made an arithmetic mistake.
- b) all the observations have the same value.
- c) there is no straight-line association.
- d) the mean must also be zero.
- e) you made an arithmetic mistake and there is no straight-line association.

16) In a batch of 5000 clock radios 7% are defective. A sample of 30 clock radios are randomly selected without replacement from the 5000 and tested. The entire batch will be rejected if at least three of those tested are defective. What is the probability that the entire batch will be rejected?

- a) 0.155 b) 0.07 c) 0.196 d) 0.845 e) 0.351

17) Let A and B be two events such that $P(A) = 0.2$, $P(B) = 0.2$, and $P(A \cup B) = 0.36$. Which statement is correct?

- a) Events A and B are the entire sample space. b) Events A and B are mutually exclusive (disjoint).
c) Events A and B are independent. d) Events A and B are both mutually exclusive and independent.
e) None of these statements are correct.

18) 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) 0.677 b) 0.19 c) 0.133 d) 0.038 e) 0.056

19) Given: $P(E) = 0.38$, $P(F) = 0.51$, and $P(E \cup F) = 0.72$. Find $P(E \cap F)$ and $P(F|E)$.

- a) $P(E \cap F) = 0.27$ and $P(F|E) = 0.31$ b) $P(E \cap F) = 0.19$ and $P(F|E) = 0.45$
c) $P(E \cap F) = 0.19$ and $P(F|E) = 0.51$ d) $P(E \cap F) = 0.16$ and $P(F|E) = 0.51$
e) $P(E \cap F) = 0.17$ and $P(F|E) = 0.45$

20) An urn has 55 marbles, 25 are blue and the rest of the marbles are red. What is the probability that if 5 marbles are selected, at least one will be blue?

- a) 0.96 b) 0.455 c) 0.80 d) 0.20 e) 0.21

21) A large scale study conducted over a one year period has shown that break-ins at home occur about 5% of the time in the population. The study also shows home security alarms went off 3% of the time when no one was breaking into the home. The security alarm failed to go off 6% of the time when someone was really breaking into the home. If an alarm is going off, what is the probability that the house was broken into?

- a) 0.9400 b) 0.9530 c) 0.1225 d) 0.0470 e) 0.6225

22) Which is an example of a discrete random variable?

- a) The name of a candy bar. b) The weight of the mixed candy bag.
c) The number of each type of candy bar in a mixed bag. d) The width of a candy bar.
e) The weight of a candy bar.

23) For the following probability distribution, find the expected value:

X	10	21	32	43	54
P(X = x)	6k	4k	6k	3k	1k

- a) 25.95 b) 32 c) 16.12 d) 20 e) 5.19

24) Which of the following are true statements?

- I. The area under the standard normal curve to the right of 3 is zero.
- II. The area below the mean of a normal curve 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.

25) The lifetime of computer monitor of a particular type are normally distributed with a mean of 12 years and a standard deviation of 1.25 years. Find the first quartile, Q_1 .

- a) 9 years b) 12.84 years c) 11.16 years d) 3 years e) 2.8 years

26) The scores on a statistics test are approximately normally distributed. The mean score is 70 points, and 95% of the class scored below 79. What is the standard deviation of this test?

- a) 9.5 b) 5.5 c) 5.05 d) 6.5 e) Not enough information.

27) The probability of winning a certain lottery is $\frac{1}{69,291}$. 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) 0.0099 d) 0.0192 e) 1.000

28) 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 the mean amount spent on food is more than \$380.

- a) 0.2119 b) 0.8413 c) 0.1587 d) 0.4502 e) 0.125

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

30) The amounts (in ounces) of juice in eight randomly selected juice bottles are:

15.4 15.0 15.1 15.6 15.0 15.6 15.7 15.8

Construct a 98% confidence interval for the mean amount of juice in all such bottles. Assume that the amount of juice has a normal distribution.

- a) (15.06, 15.74) b) (15.13, 15.67) c) (15.0, 15.8) d) (14.64, 16.15) e) (15.21, 15.71)

31) A simple random sample of 1,500 adults found that 65% expect an increase in pollution in the next 10 years. Which of these is a correct 95% confidence statement?

- a) With 95% probability, the percent of the sample who expect an increase in pollution is between 62.6% and 67.4%.
b) With 95% confidence, the percent of all adults who expect an increase in pollution is between 62.6% and 67.4%.
c) With 95% confidence, the percent of the sample who expect an increase in pollution is between 63.8% and 66.2%.
d) With 95% confidence, the percent of the sample who expect an increase in pollution is between 62.6% and 67.4%.
e) With 95% confidence, the percent of all adults who expect an increase in pollution is between 63.8% and 66.2%.

32) 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 97 percent confidence, the sample proportion will not differ from the true proportion by more than 0.027? Assume a normal distribution.

- a) 250 b) 49 c) 1615 d) 36 e) 1318

33) A pizza delivery company claims that its average delivery time is at most 45 minutes, $H_0 : \mu \leq 45$. Such that if any driver that has a mean of less than 45 minutes, they get a bonus in their paycheck. One driver did get that bonus but really, his mean delivery time was 55 minutes. This is an example of

- a) Type I error b) Type III error c) Correct decision d) Power of the test e) Type II error

34) A researcher asks a group of students to complete a survey that measures maturity. She finds that the average score for girls is higher than the average score for boys, with a p-value of 0.03. What should she conclude from this p-value?

- a) The chance that she concludes that the score for girls is higher for boys when it really is not is 3%.
b) The chance that we observe the girls score higher, given that the scores should be the same is 3%.
c) There is a 3% chance that the girls' scores are higher.
d) There is a 3% chance that the girls and boys scores are equal.
e) The chance of a girl getting a higher score than a boy is 97%.

35) The null hypothesis can be described as

- a) a statement about the sample b) the same as the research hypothesis
c) a statement of the expected results d) a statement that there is no difference
e) a statement of probability

36) Ten different students take a SAT test and then a prep class for the SAT test. Below are the scores before and after taking the prep class. Do the data suggest that the mean score after the prep class is higher at the 5% significance level? Give the test statistic for this test.

Before	475	512	492	465	523	560	610	477	501	420
After	500	540	512	530	533	603	691	512	489	458

- a) 0.0032 b) -1.245 c) 1.96 d) -3.990 e) 0.2299

37) 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 was 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 4%.

- a) Do not reject H_0 . At the 4% 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) Reject H_0 . At the 4% 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.
 c) Do not reject H_0 . At the 4% 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) Reject H_0 . At the 4% 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.
 e) None of these are correct.

38) 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	9	7	11	13	5	5

Based on these numbers, what is your test statistic?

- a) $\chi^2 = 6.4$ b) $t = 1.9451$ c) $z = 1.96$ d) $t = 3.145$ e) $\chi^2 = 2.692$

39) 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) 5.00 b) 25.0 c) 7.00 d) 1.00
 e) It is not possible to answer this question, based on the information given.

40) 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.

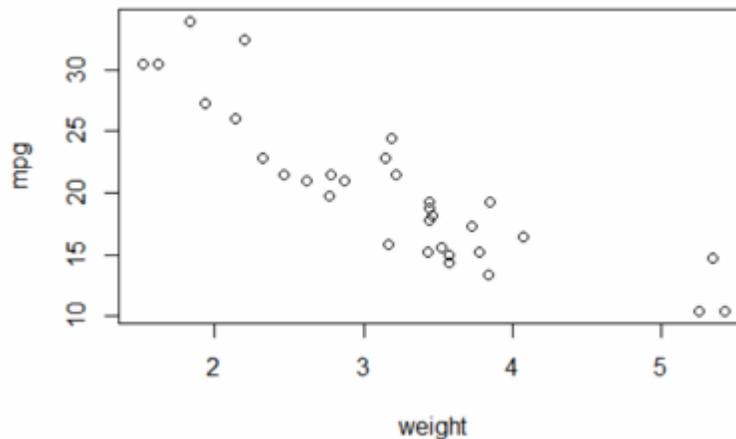
- a) Yes, because the P-value is 0.016. b) Yes, because the P-value is 0.028. c) No, because the P-value is 0.28.
 d) No, because the P-value is 0.16. e) There is not enough information to reach a conclusion.

41) 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, II, and III b) I only c) II only d) I and II e) III only

42) The following is a scatterplot of weight of cars and the mpg. What is the correlation between weight and mpg?



- a) -0.54 b) -0.867 c) -0.344 d) 0.867 e) 0.95

43) Identify the most appropriate test to use for the following situation. A national computer retailer believes that the average sales are greater for salespersons with a college degree. A random sample of 14 salespersons with a degree had an average weekly sale of \$3542 last year, while 17 salespersons without a college degree averaged \$3301 in weekly sales. The standard deviations were \$468 and \$642 respectively. Is there evidence to support the retailer's belief?

- a) One sample z-test b) One sample t-test c) Two sample t-test
 d) Two sample p-test e) Matched pairs t-test

44) If the LSRL relating the independent variable x and the dependent variable y for a given problem is y with $\hat{y} = 2x + 5$, then an increase of 1 unit in x is associated with an increase of how many units in y ?

- a) 1 b) 0 c) 5 d) 7 e) 2

45) An exceptional basketball player makes 90% of his free throws. To simulate one free throw shot by this player we could use a random digit table with

- a) Odd = made, even = missed b) 0 to 8 = made, 9 = missed c) 1 = made, 9 = missed
d) 0 to 4 = made, 5 to 9 = missed e) All of these are possible