TRUE/FALSE

1. Numerical descriptive measures computed from population measurements are called parameters.

   ANS: T PTS: 1

2. Numerical descriptive measures computed from sample measurements are called statistics.

   ANS: T PTS: 1

3. Two classes, one with 15 students and the other with 25 students, took the same test and averaged 85 points and 75 points, respectively. If the two classes were combined, the overall average score of the 40 students would be 80 points.

   ANS: F PTS: 1

4. The population mean, μ, is used to estimate the sample mean, $\bar{x}$.

   ANS: F PTS: 1

5. If the sample mean is much larger than the sample median, the data set is said to be skewed to the right.

   ANS: T PTS: 1

6. When data have been grouped (as in a frequency table, a relative frequency histogram, etc.), the class with the highest frequency is called the modal class, and the midpoint of that class is taken to be the mode.

   ANS: T PTS: 1

7. The mode is generally used to describe large data sets.

   ANS: T PTS: 1

8. The mode of a data set or a distribution of measurements, if it exists, is unique.

   ANS: F PTS: 1

9. Mound-shaped data tend to cluster around a middle value.

   ANS: T PTS: 1

10. Jessica has been keeping track of what she spends to eat out. The last week's expenditures for meals eaten out were \$15.69, \$15.95, \$16.19, \$20.91, \$17.49, \$24.53, and \$17.66. The mean amount Jessica spends on meals is \$18.35.

ANS: T PTS: 1

11. A data sample has a mean of 87, and a median of 117. The distribution of the data is positively skewed.

ANS: F PTS: 1

12. A student scores 89, 75, 94, and 88 on four exams during the semester and 97 on the final exam. If the final is weighted double and the four others weighted equally, the student's final average would be 90.

ANS: T PTS: 1

13. In a mound-shaped distribution, there is no difference in the values of the mean, and median.

ANS: T PTS: 1

14. *Measures of center* are values around which observations tend to cluster and that describe the location of what in some sense might be called the "center" of a data set.

ANS: T PTS: 1

15. The median is a measure of center that divides an ordered array of data into two halves; if the data are arranged in ascending order from smallest to largest, all the observations below the median are smaller than or equal to it, while all the observations above the median are equal to it or larger.

ANS: T PTS: 1

16. The mode is the sum of a data set's minimum plus maximum values, divided by 2.

ANS: F PTS: 1

17. If the variability of a set of data is very small, then the sample variance may be negative.

ANS: F PTS: 1

18. When all the numbers in the data set are the same, the standard deviations must be zero.

ANS: T PTS: 1

19. In all cases, the sum of the deviations of the measurements from their mean is 0.

ANS: T PTS: 1

20. The sample variance is approximately the average of the squared deviations of the measurements from their mean.

ANS: T PTS: 1

21. The sample variance calculated with a divisor of n gives a better estimate of the population variance, σ^2, than does the sample variance, s^2, with a divisor of n - 1.

ANS: F PTS: 1

22. The larger the values of the sample variance s^2 and sample standard deviation *s*, the greater the variability in the data.

ANS: T PTS: 1

23. In order to measure the variability in the same units as the original observations, we compute the sample variance.

ANS: F PTS: 1

24. Measures of variability describe typical values in the data.

ANS: F PTS: 1

25. The mean is one of the most frequently used measures of variability.

ANS: F PTS: 1

26. The range is considered the weakest measure of variability.

ANS: T PTS: 1

27. The range is considered the weakest measure of variability.

ANS: T PTS: 1

28. The value of the standard deviation will always exceed that of the variance.

ANS: F PTS: 1

29. The standard deviation is expressed in terms of the original units of measurement but the variance is not.

ANS: T PTS: 1

30. The value of the standard deviation may be either positive or negative, while the value of the variance will always be positive or zero.

ANS: F PTS: 1

31. The standard deviation is the positive square root of the variance.

ANS: T PTS: 1

32. A sample of 20 observations has a standard deviation of 4. The sum of the squared deviations from the sample mean is 76.

ANS: F PTS: 1

33. The value of the mean times the number of observations equals the sum of all of the observations.

ANS: T PTS: 1

34. In a histogram, the proportion of the total area which must be to the left of the median is less than 0.50 if the distribution is skewed to the left.

ANS: F PTS: 1

35. In a histogram, the proportion of the total area which must be to the left of the median is more than 0.50 if the distribution is skewed to the right.

ANS: F PTS: 1

36. If two data sets have the same range, the variances in both sets will be the same.

ANS: F PTS: 1

37. The sum of the deviations squared from the mean is always zero.

ANS: F PTS: 1

38. *Measures of variability* are numbers that indicate the spread or scatter of observations; they show the extent to which individual values in a data set differs from one another and, hence, differ from their central location.

ANS: T PTS: 1

39. A parameter and statistic can be used interchangeably.

ANS: F PTS: 1

40. The median is one of the most commonly used measures of variability.

ANS: F PTS: 1

41. For distributions of data that are skewed to the left or right, the median would likely be the best measure of center.

ANS: T PTS: 1

42. You are given the data values 5, 10, 15, 20, and 25. If these data were considered to be a population, and you calculated the mean, you would get the same answer as if these data were considered to be a sample from another larger population.

ANS: T PTS: 1

43. The value $(n + 1) / 2$ indicates the value of the median in an ordered data set, where n is the number of data values.

ANS: F PTS: 1

44. For any distribution, if the mean is equal to the standard deviation, you can infer that the distribution is symmetric.

ANS: F PTS: 1

45. A distribution is said to be skewed to the right if the population mean is larger than the sample mean.

ANS: F PTS: 1

46. One advantage of using the median as a measure of center is that its value is not affected by extreme values.

ANS: T PTS: 1

47. A data set in which the mean and median are equal is said to be bimodal data.

ANS: F PTS: 1

48. If the mean value of a distribution is 85 and the median is 67, the distribution must be skewed to the right.

ANS: T PTS: 1

49. One of the advantages of the standard deviation over the variance as a measure of variability is that the standard deviation is measured in the original units.

ANS: T PTS: 1

50. For any distribution, the standard deviation is a measure of variability of the data around the median.

ANS: F PTS: 1

51. Suppose the standard deviation for a given sample is known to be 12. If each data value in the sample is multiplied by 3, the standard deviation will be 36.

ANS: F PTS: 1

MULTIPLE CHOICE

1. Which measure of center is meaningful when the data are qualitative?

a. the mean
b. the median
c. the mode
d. all of the these
e. none of these

ANS: C PTS: 1

2. Which of the following statements is true?

   a. When the distribution is skewed to the left, mean > median.
   b. When the distribution is skewed to the right, mean < median.
   c. When the distribution is symmetric and unimodal, mean = median.
   d. When the distribution is symmetric and unimodal, mean = variance.
   e. None of these is true.

   ANS: C PTS: 1

3. Which of the following statements is true for a symmetric distribution?

   a. The mean is greater than the median.
   b. The mean is less than the median.
   c. The mean and median are equal.
   d. None of these
   e. All of these.

   ANS: C PTS: 1

4. In a histogram, the proportion of the total area which must be to the right of the mean is:

   a. less than 0.50 if the distribution is skewed to the left
   b. exactly 0.50
   c. more than 0.50 if the distribution is skewed to the right
   d. exactly 0.50 if the distribution is symmetric and unimodal
   e. none of these

   ANS: D PTS: 1

5. Which of the following statements is true for the following data values: 17, 15, 16, 14, 17, 18, and 22?

   a. The mean, median and mode are all equal.
   b. Only the mean and median are equal.
   c. Only the mean and mode are equal.
   d. Only the median and mode are equal.
   e. The mean, median and mode are all different.

   ANS: A PTS: 1

6. Since the population is always larger than the sample, the population mean:

   a. is always larger than the sample mean
   b. is always smaller than the sample mean
   c. is always larger than or equal to the sample mean
   d. can be smaller than, or larger than, or equal to the sample mean
   e. is always smaller than or equal to the sample mean

   ANS: D PTS: 1

7. The average score for a class of 35 students was 70. The 20 male students in the class averaged 73. The 15 female students in the class averaged:

   a. 73
   b. 70
   c. 66
   d. 60
   e. 35

   ANS: C PTS: 1

8. Which of the following statements about the mean is not always correct?

   a. The sum of the deviations from the mean is zero.
   b. Half of the observations are on either side of the mean.
   c. The mean is a measure of the middle (center) of a distribution.
   d. The value of the mean times the number of observations equals the sum of all of the observations.
   e. The sum of the deviations from the mean is zero and half of the observations are on either side of the mean.

   ANS: B PTS: 1

9. In a histogram, the proportion of the total area which must be to the left of the median is:

   a. exactly 0.50
   b. less than 0.50 if the distribution is skewed to the left
   c. more than 0.50 if the distribution is skewed to the right
   d. between 0.25 and 0.75 if the distribution is symmetric
   e. all of these

   ANS: A PTS: 1

10. Data about qualitative variables can be summarized by:

    a. measures of center
    b. measures of variability
    c. proportions
    d. measures of relative standing
    e. all of these

    ANS: C PTS: 1

11. Which of the following best describes measures of center?

    a. They are numbers around which observations tend to cluster and that describe the location of what in some sense might be called the center of a data set.
    b. They are numbers that indicate the spread or scatter of observations and show the extent to which individual values in a data set differ from one another and, hence, differ from their central location.
    c. They are numbers that indicate the degree of asymmetry in a frequency

distribution.

d. None of these.
e. All of these.

ANS: A PTS: 1

12. Consider the data set: 5, 6, 7, 11, and 15. Its mean equals:

a. 7.0
b. 8.8
c. 8.1
d. 7.3
e. 9

ANS: B PTS: 1

13. Which of the following statements about the median is correct?

a. It is a measure of center that divides an ordered array of data into two halves.
b. If data are arranged in ascending order from smallest to largest, all the observations below the median are smaller than or equal to it, while all the observations above the median are equal to it or larger.
c. If the total number of observations is odd, the median is the middle observation in an ordered array; if the total number of observations is even, the median is the average of the two middle values.
d. All of these.
e. None of these.

ANS: D PTS: 1

14. A random sample from an unknown population had a sample standard deviation of zero. Which one of the following is a reasonable conclusion?

a. The sample range must be zero.
b. An error was made in computing the sample standard deviation. It must always be greater than zero.
c. The population standard deviation must be zero.
d. The population standard deviation must be zero when the mean is zero.
e. None of these.

ANS: A PTS: 1

15. The following data represent a sample of 10 scores on a 20-point statistics quiz: 16, 16, 16, 16, 16, 18, 18, 20, 20, and 20. After the mean, median, range and variance were calculated for the scores, it was discovered that one of the scores of 20 should have been an 18. Which of the following will change when the calculations are redone using the correct scores?

a. mean and range
b. median and range
c. mean and variance
d. range and variance

e. mean, range, median and variance

ANS: C PTS: 1

16. Which of the following represents a disadvantage of using the sample range to measure spread or dispersion?

a. It produces spreads that are too large.
b. The sample range is not measured in the same units as the data.
c. The largest or smallest observation (or both) may be an outlier.
d. None of these is correct.
e. All of these are correct.

ANS: C PTS: 1

17. The following ten scores were obtained on a 20-point quiz: 4, 5, 8, 9, 11, 13, 15, 18, 18, and 20. The teacher computed the usual descriptive measures of center (central tendency) and variability (dispersion) for these data, and then discovered an error was made. One of the 18's should have been a 16. Which one of the following measures, calculated on the corrected data, would change from the original computation?

a. mean and standard deviation
b. mean and median
c. range and median
d. mean and range.
e. mean, standard deviation, range and median

ANS: A PTS: 1

18. Which of the following statements is true for the following data values: 17, 15, 16, 14, 17, 18, and 22?

a. The mean, median and mode are all equal.
b. Only the mean and median are equal.
c. Only the mean and mode are equal.
d. Only the median and mode are equal.
e. The median and mode are not equal.

ANS: A PTS: 1

19. Which of the following statements is true?

a. The sum of the deviations from the mean is always zero.
b. The sum of the squared deviations from the mean is always zero.
c. The standard deviation is always smaller than the variance.
d. The distance between the first and third quartiles is twice the distance between the first and second quartiles.
e. None of these is true.

ANS: A PTS: 1

20. Which of the following is not a measure of variability?

a. the variance
b. the standard deviation
c. the mean
d. the range
e. all are measures of variability

ANS: C PTS: 1

21. If two data sets have the same range:

a. the distances from the smallest to largest observations in both sets will be the same
b. the smallest and largest observations are the same in both sets
c. both sets will have the same variance
d. both sets will have the same interquartile range
e. both sets will have the same mean

ANS: A PTS: 1

22. A sample of 25 observations has a standard deviation of 4. The sum of the squared deviations from the sample mean is:

a. 21
b. 25
c. 100
d. 384
e. 400

ANS: D PTS: 1

23. Numbers that indicate the spread or scatter of observations in a data set are:

a. measures of center
b. measures of location
c. measures of variability
d. measures of shape
e. all of these

ANS: A PTS: 1

24. The variance is:

a. a mean of absolute deviations
b. a mean of positive and negative deviations
c. a mean of squared deviations
d. a mean of positive deviations
e. no mean at all

ANS: C PTS: 1

25. If a store manager selected a sample of customers and computed the mean income for this sample, he has computed:

a. a parameter
b. a statistic
c. a qualitative value
d. all of these
e. none of these

ANS: B PTS: 1

26. Which of the following statements is true?

a. The population mean will always be larger than the mean of a sample selected from that population.
b. The population mean will always be larger than the population median.
c. The population mean and the mean of a sample selected from that population will usually be different values.
d. The population mean will always be equal to the population median.
e. All of these.

ANS: C PTS: 1

27. A sample of students who have taken a calculus test has a mean score of 78.2, a mode of 67, and a median score of 67. Based on this information, the distribution of test scores is:

a. symmetric
b. right skewed
c. left skewed
d. bimodal
e. none of these

ANS: B PTS: 1

28. Which of the following is the most frequently used measure of variation?

a. the mean
b. the range
c. the variance
d. the standard deviation
e. the median

ANS: D PTS: 1

29. Which of the following measures is not affected by extreme values in the data?

a. the mean
b. the median
c. the variance
d. the range
e. the standard deviation

ANS: B PTS: 1

30. Suppose that the distribution of actual weight of students in your university or college is thought to be symmetric. If the average weight is 168 pounds, what would the median weight be?

    a. larger than 168 pounds
    b. smaller than 168 pounds
    c. 168 pounds
    d. There is not enough information to answer this question.

    ANS: C PTS: 1

PROBLEM

1. The time required for ten children to learn a particular motor skill was recorded as 9, 15, 23, 20, 16, 15, 24, 18, 10, and 20 minutes.

    a. Find the mean time to learn this task.

    _____

    b. Find the median time to learn this task.

    _____

    c. Based on the values of the mean and median in parts (a) and (b) above, are the measurements symmetric or skewed?

    _____

    Explain.

    _____

    ANS:
    17; 17; Symmetric; Since the mean and median values are the same, we conclude that the measurements are symmetric.

    PTS: 1

2. You are given the following measurements: 0.10, 0.25, 0.20, 0.15, and 0.16.

    a. Multiply each of the values by 100, and calculate the sample mean for the new data.

    _____

b. Without actually calculating the sample mean, what was the mean of the original data?

_____

ANS:
17.20; .172

PTS: 1

3. A sample of eight doctors was asked how many flu shots they had given to patients this fall. The numbers of flu shots were 6, 3, 5, 24, 2, 6, 0, and 8.

   a. Find the sample mean.

   _____

   b. Find the sample median.

   _____

   c. Based on the values of the mean and median in parts (a) and (b) above, are the measurements symmetric or skewed?

   _____

   Explain.

   _____

   ANS:
   6.75; 5.5; Skewed right; Since the mean is larger than the median, we conclude that the measurements are skewed to the right.

   PTS: 1

4. In assembling a home appliance, workers generally finish the process within 30 minutes to one hour. Occasionally, due to system failures, the assembly process takes a long time, possibly as long as 4 to 5 hours. What is the most appropriate measure of central tendency to use in this case if you want the measure to be representative of most of the observed times?

   _____

   Why is it the most appropriate measure?

_____

ANS:
Median; Median is the most appropriate measure because it is not influenced by extreme values.

PTS: 1

5. The following data represent scores on a 15 point aptitude test: 8, 10, 15, 12, 14, and 13.

   a. Complete the **sample mean** for the *original* data.

   _____

   Subtract 5 from every observation and complete the **sample mean** for the *new* data.

   _____

   b. Complete the **sample variance** for the *original* data.

   _____

   Subtract 5 from every observation and complete the **sample variance** for the *new* data.

   _____

   c. What effect, if any, does subtracting 5 from every observation have on the sample mean and sample variance?

   _____

   ANS:
   12; 7; 6.8; 6.8; The sample mean is shifted to the left (decreased by 5), but the sample variance remains unchanged.

   PTS: 1

6. Thirty-three students were asked to rate themselves on whether they were outgoing or not using this five point scale: 1 = extremely extroverted, 2 = extroverted, 3 = neither extroverted nor introverted, 4 = introverted, or 5 = extremely introverted. The results are shown in the table below:

Rating x_i	1	2	3	4	5
Frequency f_i	1	7	20	5	0

a. Calculate the sample mean.

_____

b. Calculate the median.

_____

c. Calculate the sample standard deviation.

_____

ANS:
2.88; 3; 0.69

PTS: 1

7. The following data represent the number of small cracks per bar for a sample of eight steel bars:

   4 6 10 1 3 1 25 8

   a. Find the average number of small cracks per bar.

   _____

   b. Find the standard deviation for the number of small cracks per bar.

   _____

   ANS:
   7.25; 7.85

   PTS: 1

8. Twenty-eight applicants interested in working for the Food Stamp program took an examination designed to measure their aptitude for social work. A stem-and-leaf plot of the 28 scores appears below, where the first column is the count per branch, the second column is the stem value, and the remaining digits are the leaves.

Count	Stems	Leaves
1	4	6
1	5	9
4	6	3688
6	7	026799
9	8	145667788
7	9	1234788

a. What is the median score?

_____

b. What is the sample mean for this data set?

_____

c. What is the value of the sample standard deviation?

_____

d. What is the range of this data?

_____

ANS:
84.5; 80.64; 12.85; 52

PTS: 1

9. Suppose you are given the following set of sample measurements:

-1, 0, 2, 6, 5, 6

a. Calculate the sample mean.

_____

b. Find the median.

_____

c. Find the mode.

_____

d. Calculate the sample variance.

_____

e. Calculate the sample standard deviation.

_____

f. Calculate the range.

_____

g. Is this data symmetric, skewed to the right or skewed to the left?

_____

Justify your answer.

_____

ANS:
3; 3.5; 6; 9.6; 3.0984; 7; Skewed to the left; The data is skewed to the left since the mean is less than the median.

PTS: 1

10. A neighborhood ice cream vendor reports the following sales of single scoop ice cream cones (measured in hundreds of cones) for five randomly selected weeks:

    5 4 6 5 3

    a. Find the average number of weekly sales of single scoop ice cream cones.

    _____

    b. Find the median number of weekly sales of single scoop ice cream cones.

    _____

c. Find the variance for the weekly sales of single scoop ice cream cones.

_____

ANS:
4.6; 5; 1.3

PTS: 1

11. The following data represents the sales (measured in $10,000) of seven real estate salespersons employed by a local agency:

23 34 56 47 45 60 249

Which measure of center, the mean or the median, would provide a better measure of the average sales of the company?

_____

Explain.

_____

ANS:
Median; The median would seem to provide a better measure of the average sales since it will not be adversely affected by the extreme value of 249. (The mean will be pulled strongly to the right by the extreme value of 249.)

PTS: 1

12. The following data represent the number of calories in 12 ounce cans of eight popular soft drinks:

124 144 147 146 148 154 150 234

a. Find the median.

_____

b. Find the sample mean.

_____

c. Based on the values in parts (a) and (b) above, are the measurements symmetric or skewed?

_____

Explain.

_____

ANS:
147.5; 155.875; Skewed right; Since the mean is larger than the median, we conclude that the measurements are skewed to the right.

PTS: 1

13. In a psychological experiment, the time on task was recorded for ten subjects under a 5-minute time constraint. These measurements are in seconds:

182 197 207 272 192 257 247 197 232 237

a. Find the average time on task.

_____

b. Find the median time on task.

_____

c. If you were writing a report to describe these data, which measure of central tendency would you use?

_____

Explain.

_____

ANS:
222; 219.5; Mean; Since there are no unusually large or small observations to affect the value of the mean, we would probably report the mean or average time on task.

PTS: 1

14. You are given $n = 8$ measurements: 13, 11, 15, 16, 14, 14, 13, and 15.

Calculate the range.

_____

Calculate the sample mean.

_____

Calculate the sample variance.

_____

Calculate the standard deviation.

_____

Compare the range and the standard deviation. The range is approximately how many standard deviations?

_____

ANS:
5; 13.875; 2.4107; 1.5526; 3.22

PTS: 1

15. A sample of $n = 10$ measurements consists of the following values:

15, 12, 13, 16, 11, 12, 14, 15, 11, 13

a. Find the mean.

_____

b. Find the median.

_____

c. Based on the values in parts (a) and (b) above, are the measurements symmetric or skewed?

_____

Explain.

_____

d. Find the standard deviation.

_____

e. Find the range.

_____

f. Use the range to approximate *s*.

_____

g. Is this a good approximation?

_____

ANS:
13.2; 13; Skewed to the right; Since the mean is slightly larger than the median, we conclude that the measurements are slightly skewed to the right.; 1.75; 5; 1.25; Yes

PTS: 1

16. The following data represent the scores for a sample of 10 students on a 20-point chemistry quiz:

    16 14 2 8 12 12 9 10 15 13

    a. Calculate the median.

    _____

    b. Calculate the sample mean.

    _____

    c. Calculate the sample variance.

    _____

ANS:
12; 11.1; 16.767

PTS: 1

17. Assume that all employees of a community college received a $150 monthly raise.

a. How would this affect the mean of salaries?

_____

b. How would this affect the standard deviation of salaries?

_____

ANS:
The mean will increase by $150; The standard deviation will remain unchanged

PTS: 1

18. The following values denote the number of customers handled by an optometrist during a random sample of four periods of one hour each: 4, 6, 2, and 5.

a. Find the standard deviation of these values.

_____

b. Find the range, *R*.

_____

ANS:
1.708; 4

PTS: 1