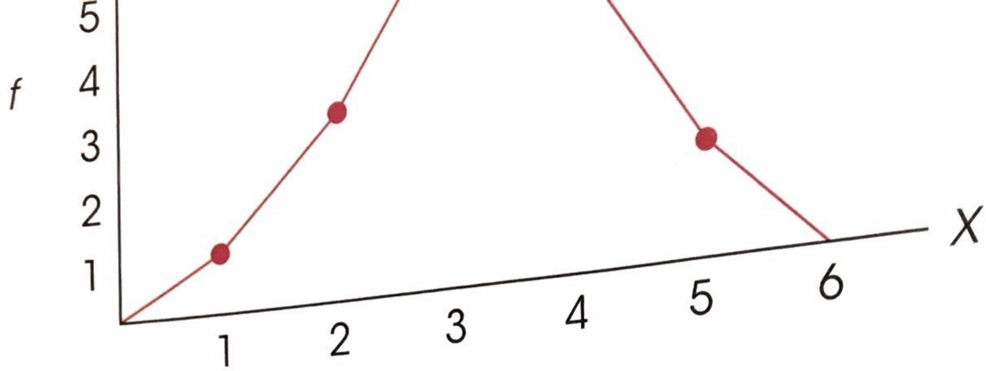

14. Place the following scores in a frequency distribution table. Based on the frequencies, what is the shape of the distribution?

13, 14, 12, 15, 15, 14, 15, 11, 13, 14
11, 13, 15, 12, 14, 14, 10, 14, 13, 15

15. For the following set of scores:

8, 6, 7, 5, 4, 10, 8, 9, 5, 7, 2, 9
9, 10, 7, 8, 8, 7, 4, 6, 3, 8, 9, 6

a. Construct a frequency distribution table.
b. Sketch a histogram showing the distribution.
c. Describe the distribution using the following characteristics:
(1) What is the shape of the distribution?
(2) What score best identifies the center (average) for the distribution?
(3) Are the scores clustered together, or are they spread out across the scale?

16. Recent research suggests that the amount of time that parents spend talking about numbers can have a big impact on the mathematical development of their children (Levine, Suriyakham, Rowe, Huttenlocher, & Gunderson, 2010). In the study, the researchers visited the children's homes between the ages of 14 and 30 months and recorded the amount of "number talk" they heard from the children's parents. The researchers then tested the children's knowledge of the meaning of numbers at 46 months. Th... ing data are simil...

dren with
colors or us
line for the
ence betwee

17. Complete th
quency distr
and percent

a. What is
b. What is
c. What is
d. What is

18. Complete th
quency distr
and percenti

X
25–
20–
15–
10–
5–
0–

a. What is t
b. What is

DEMONSTRATION 4.1

COMPUTING MEASURES OF VARIABILITY

For the following sample data, compute the variance and standard deviation. The scores are:

10, 7, 6, 10, 6, 15

STEP 1 **Compute SS, the sum of squared deviations** We will use the computational formula. For this sample, $n = 6$ and

$$\Sigma X = 10 + 7 + 6 + 10 + 6 + 15 = 54$$

$$\Sigma X^2 = 10^2 + 7^2 + 6^2 + 10^2 + 6^2 + 15^2 = 546$$

$$SS = \Sigma X^2 - \frac{(\Sigma X)^2}{N} = 546 - \frac{(54)^2}{6}$$

$$= 546 - 486$$

$$= 60$$

STEP 2 **Compute the sample variance** For sample variance, SS is divided by the degrees of freedom, $df = n - 1$.

$$s^2 = \frac{SS}{n-1} = \frac{60}{5} = 12$$

STEP 3 **Compute the sample standard deviation** Standard deviation is simply the square root of the variance.

$$s = \sqrt{12} = 3.46$$

PROBLEMS

1. In words, explain what is measured by SS, variance, and standard deviation.

2. Is it possible to obtain a negative value for the variance or the standard deviation?

3. Describe the scores in a sample that has a standard deviation of zero.

4. ... r methods that can

6. Calculate SS, variance, and standard deviation for the following population of $N = 5$ scores: 2, 13, 4, 10, 6. (*Note:* The definitional formula works well with these scores.)

7. Calculate SS, variance, and standard deviation for the following population of $N = 7$ scores: 8, 1, 4, 3, 5, 3, 4. (*Note:* The definitional formula works well with

...cademy of ...
Markov's first interest was in
calculus. He did not start his
work in probability theory
until 1883, when Chebyshev
left the university and Markov
took over his teaching duties.
A large and influential body
of work followed, including
applications of the weak law
of large numbers and what are
now known as Markov processes
and Markov chains. His work
on processes and chains would
later influence the development

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...of scores: 1, 4, 3, 5, 7
...population, what are the vari-
...deviation?
...ample, what are the variance
...ion?

...sample variance different from
...on variance?

...e of $n = 6$ scores: 0, 11, 5,

...owing the sample

...ue of the sample mean in your
sketch, and make an estimate of the standard deviation (as done in Example 4.6).

c. Compute *SS*, variance, and standard deviation for the sample. (How well does your estimate compare with the actual value of s?)

12. Calculate *SS*, variance, and standard deviation for the following sample of $n = 8$ scores: 0, 4, 1, 3, 2. 1, 1, 0.

13. Calculate *SS*, variance, and standard deviation for the following sample of $n = 5$ scores: 2, 9, 5, 5, 9.

14. A population has a mean of $\mu = 50$ and a standard deviation of $\sigma = 10$.

a. If 3 points were added to every score in the population, what would be the new values for the mean and standard deviation?

b. If every score in the population were multiplied by 2, then what would be the new values for the mean and standard deviation?

15. a. After 6 points have been added to every score in a sample, the mean is found to be $M = 70$ and the standard deviation is $s = 13$. What were the values for the mean and standard deviation for the original sample?

b. After every score in a sample is multiplied by 3, the mean is found to be $M = 48$ and the standard deviation is $s = 18$. What were the values for the mean and standard deviation for the original sample?

16. Compute the mean and standard deviation for the following sample of $n = 4$ scores: 82, 88, 82, and 86. Hint: To simplify the arithmetic, you can subtracted 80 points from each score to obtain a new sample consisting of 2, 8, 2, and 6. Then, compute the mean and standard deviation for the new sample. Use the values you obtain to find the mean and standard deviation for the original sample.

17. For the following sample of $n = 8$ scores: 0, 1, $\frac{1}{2}$, 0, 3, $\frac{1}{2}$, 0, and 1:

a. Simplify the arithmetic by first multiplying each score by 2 to obtain a new sample of 0, 2, 1, 0, 6, 1, 0, and 2. Then, compute the mean and standard deviation for the new sample.

b. Using the values you obtained in part a, what are the values for the mean and standard deviation for the original sample?

18. For the following population of $N = 6$ scores:

2, 9, 6, 8, 9, 8

a. Calculate the range and the standard deviation. (Use either definition for the range.)

b. Add 2 points to each score and compute the range and standard deviation again. Describe how adding a constant to each score influences measures of variability.

19. The range is completely determined by the two extreme scores in a distribution. The standard deviation, on the other hand, uses every score.

a. Compute the range (choose either definition) and the standard deviation for the following sample of $n = 5$ scores. Note that there are three scores clustered around the mean in the center of the distribution, and two extreme values.

Scores: 0, 6, 7, 8, 14.

b. Now we will break up the cluster in the center of the distribution by moving two of the central scores out to the extremes. Once again compute the range and the standard deviation.

New scores: 0, 0, 7, 14, 14.

c. According to the range, how do the two distributions compare in variability? How do they compare according to the standard deviation?

20. For the data in the following sample:

10, 6, 8, 6, 5

a. Find the mean and the standard deviation.

b. Now change the score of $X = 10$ to $X = 0$, and find the new mean and standard deviation.

c. Describe how one extreme score influences the mean and standard deviation.

21. Within a population, the differences that exist from one person to another are often called diversity.