# Chapter 2 The Mean, Variance, Standard Deviation, and *Z* Scores

1) The representative value of a group of scores refers to the middle of the group of scores. All of the following are types of representative values EXCEPT:

   A) mean

   B) metric

   C) mode

   D) median

   Answer: B

2) A researcher observes the level of aggression of six 5-year-old boys over the course of a school day. The number of incidents for the group of boys was 2, 4, 6, 12, 8, 10. What is the mean number of aggressive acts for this group of children?

   A) 4

   B) 5

   C) 7

   D) 9

   Answer: C

3) Five people's scores on a survey of product recognition are 17, 12, 20, 13, 8. What is their mean score?

   A) 12

   B) 13

   C) 14

   D) 10

   Answer: C

4) The ordinary average of a group of numbers is called the _____.

   A) median

   B) mean

   C) standard deviation

   D) mode

   Answer: B

5) The rule for calculating the mean is to add up all the scores in a sample and divide by the _____.

A) median

B) number of scores minus 1

C) number of scores

D) most frequent score

Answer: C

6) Based on the scores 1, 9, 3, 6, 1, 2, 6, 2, 2, 8, a score of 4 is the _____.

A) mode

B) median

C) mean

D) standard deviation

Answer: C

7) In statistical formulas, what does *N* stand for?

A) The number of different values possible on the variable

B) The number of scores in a distribution

C) The normal curve

D) The normalized *Z* score in a distribution of scores

Answer: B

8) A research team studied the rate at which infants in the three different countries vocalized distress. Below are the scores from each country. Which group of infants showed the highest mean rate of distress vocalization over the 45-minute observation period?

Country A: 9, 9, 10, 13, 8, 8, 11, 11, 10, 7, 13, 6, 18, 9, 9, 12, 13, 10, 5, 14
Country B: 15, 15, 16, 19, 14, 14, 17, 17, 16, 13, 19, 12, 18, 10, 10, 15, 15, 2, 2, 5
Country C: 4, 6, 20, 17, 15, 30, 18, 18, 25, 2, 29, 17, 16, 35, 19, 1, 30, 25, 16, 15

A) Country A

B) Country B

C) Country C

D) Countries B and C were equal

Answer: C

9) The most common single number in a group of scores is the:

A) mode

B) mean

C) median

D) average

Answer: A

10) What is the mode of the following scores: 3, 4, 6, 7, 10, 10, 30, 10, 30, 4, 3, 8 ?

A) 3

B) 4

C) 8.5

D) 10

Answer: D

11) Based on the following scores 1, 2, 3, 4, 5, 6, 8, 8, 8, 9, 10, a score of 8 is the:

A) mean

B) median

C) mode

D) standard deviation

Answer: C

12) What is the median of the following group of scores: 1, 2, 2, 3, 4, 4, 4, 6, 8, 10?

A) 3

B) 5.5

C) 4

D) 3.5

Answer: C

13) The middle value in a set of scores lined up from lowest to highest is the:

A) mean

B) mode

C) average

D) median

Answer: D

14) What is the median of the following scores: 4, 4, 6, 7, 8, 8, 9, 10, 11, 2, 1, 4?

A) 4

B) 5.5

C) 6.5

D) 8.5

Answer: C

15) A Canadian political scientist discovers that the number of members of their provincial parliament that a group of voters can name is as follows: 3, 3, 3, 4, 4, 5, 6, 7, 8, 9, 10, 35. Upon examination of these scores, the researcher would probably decide to use which measure of the typical value?

A) Mean

B) Median

C) Mode

D) Standard deviation

Answer: B

16) Which statement is true for the scores 1, 2, 3, 4, 5, 5, 7, 8, 9, 10, 12, 12, 13?

A) The mode is greater than the median

B) The median is greater than the mean

C) The median is greater than the mode

D) The mode is greater than the mean

Answer: C

17) When a distribution is skewed to the right:

A) the median is greater than the mean

B) the mean and the median are the same

C) the mean is greater than the median

D) the mean and the median are equal

Answer: C

18) The median is greater than the mean in a distribution that is:

A) symmetrical

B) skewed to the right

C) normal

D) skewed to the left

Answer: D

19) The capital Greek letter "sigma" is the symbol for:

A) "average of"

B) "sum of"

C) "variance of"

D) "median of"

Answer: B

20) In a perfectly symmetrical unimodal distribution:

A) there are two values with the highest frequency of scores

B) the mode is slightly less than the mean

C) the mean is larger than the median

D) the mode is the same as the mean

Answer: D

21) The mode can be a poor representative value because:

A) it can be difficult to calculate without a statistical software package

B) it does not reflect many aspects of the distribution

C) it is generally larger than the mean

D) all of the above

Answer: B

22) The _____ is the usual way of describing the representative value for a nominal variable such as religious affiliation.

A) mean

B) outlier

C) median

D) mode

Answer: D

23) In a distribution with an even number of scores, the *median* will be the:

A) most common value

B) average of the two middle scores

C) the median divided by the mean

D) the sum of score divided by $N - 1$

Answer: B

24) Unless there are _____, behavioral and social scientists generally use the mean as the measure of the representative value of a group of scores.

A) outliers

B) histograms

C) *Z* scores

D) two modes

Answer: A

25) While the mean provides a representative value of a group of scores, it does not tell about the _____.

A) variability of the scores

B) average of the scores

C) spread of the scores around the mean

D) both A and C

Answer: D

26) Place the five steps for computing variance into the correct order:
1. Divide the sum of squared deviations by the number of scores.
2. Subtract the mean from each score.
3. Add up the squared deviation scores.
4. Compute the mean of the sample.
5. Square each of the deviation scores.

A) 2, 3, 1, 4, 5

B) 5, 1, 2, 4, 3

C) 4, 5, 2, 1, 3

D) 4, 2, 5, 3, 1

Answer: D

27) In order to compute the range of a group of scores, one must:

A) subtract the lowest score from the highest score

B) multiply the lowest score by the average

C) multiply the highest score by the average

D) subtract the lowest score from the highest and divide by *N*

Answer: A

28) The variance of a group of scores is the same as the:

A) average of the squared deviations from the mean

B) sum of the squared deviations about the mean

C) average of the absolute deviations from the mean

D) sum of the absolute deviations from the median

Answer: A

29) In a class of students in which everyone is exactly 24 years old, the variance would be:

A) approximately 1

B) exactly 0

C) between 0 and 1

D) impossible to determine without more information

Answer: B

30) The variance of a group of scores is 9. What is the standard deviation?

A) 1

B) 3

C) 4.5

D) 81

Answer: B

31) The most widely used way of describing the spread of a group of scores is the:

A) range

B) variance

C) square root transformation

D) standard deviation

Answer: D

32) Roughly speaking, the standard deviation is the average amount that scores differ from the:

A) histogram

B) median

C) mean

D) range

Answer: C

33) The standard deviation is defined as the:

A) positive square root of the variance

B) positive square root of the range

C) negative square root of the variance

D) positive square root of the mean or median

Answer: A

34) Measures of variability, such as the variance and standard deviation, are heavily influenced by the presence of one or more:

A) average scores

B) computational formulas

C) variables

D) extreme scores or outliers

Answer: D

35) The standard deviation of a group of scores is 4. What is the variance?

A) 2

B) 4

C) 8

D) 16

Answer: D

36) A researcher surveys job satisfaction among laborers and white-collar workers. (Job satisfaction is rated on a scale from 1 = low satisfaction to 10 = high satisfaction.) Results show that laborers have a mean job satisfaction score of 3 and a variance of 1; white-collar workers have a mean job satisfaction rating of 7 and a variance of 10. Which statement best describes what these numbers mean?

A) White-collar workers are less satisfied than laborers.

B) White-collar workers and laborers are about equally satisfied.

C) Laborers generally are less satisfied than white-collar workers, but laborers are just as likely to be highly satisfied as white-collar workers are to be highly dissatisfied.

D) Laborers are less satisfied than white-collar workers and most laborers are about equally dissatisfied while there is more variation in the satisfaction of white-collar workers.

Answer: D

37) What is the variance of these three scores: 1, 4, 7?

A) 3

B) 4

C) 6

D) 9

Answer: C

38) What is the variance of these four scores: 0, 1, 1, 2?

A) .25

B) .5

C) .86

D) 1

Answer: B

39) What is the standard deviation of these four scores: 2, 4, 3, 7?

A) 1.87

B) 2.35

C) 3.50

D) 4.05

Answer: A

40) In a distribution of *Z* scores, the mean is always:

A) 10

B) 1

C) 0

D) 50

Answer: C

41) A _____ describes a particular score in terms of where it fits into the overall group of scores.

A) standard deviation

B) computational formula

C) *Z* score

D) *Q* score

Answer: C

42) All of the following are true statements about a *Z* score EXCEPT:

A) it is the number of standard deviations the actual score is above or below the mean

B) it is negative if the actual score falls below the mean

C) it is negative if the actual score falls above the mean

D) it is zero if the actual score falls at the mean

Answer: C

43) Donald's score on the statistics test was +1.25. This means that he scored:

A) slightly below the average

B) just at the average

C) a little less than one standard deviation below the mean

D) more than one standard deviation above the mean

Answer: D

44) As compared to a *Z* score, a *raw score* is:

A) a transformed score

B) an ordinary score

C) a scaled score

D) a standardized score

Answer: B

45) Which of the following is NOT an advantage of *Z* scores?

A) You can compare scores from scales with different amounts of variation.

B) You can easily tell if a score is above or below the mean.

C) You can easily tell how far above or below the mean a score is.

D) You can easily tell the shape of the scores' distribution.

Answer: D

46) For the questions below: A statistics student (Lee) wants to compare his final exam score to his friend Zoey's final exam score from last year. However, the two exams were scored on different scales. Lee asks Zoey for the mean and standard deviation of her class on the exam as well as her final exam score. Compute the $Z$ scores for Lee and Zoey.
Lee: Final exam score = 85; Class: $M = 70$; $SD = 10$
Zoey: Final exam score = 45; Class: $M = 35$; $SD = 5$

A) Lee, $Z = 1.50$; Zoey, $Z = 2.00$

B) Lee, $Z = -1.07$; Zoey, $Z = -1.14$

C) Lee, $Z = 1.07$; Zoey, $Z = -1.14$

D) Lee, $Z = 1.07$; Zoey, $Z = 1.50$

Answer: A

47) In relation to the other people in their classes, who had the better exam score?

A) Lee

B) Zoey

C) They were equal

D) It is not possible to say without more information

Answer: B

48) A $Z$ score of 2.0 came from a distribution with a mean of 80 and a standard deviation of 10. What is the raw score?

A) 82

B) 90

C) 100

D) 170

Answer: C

49) A person's raw score is 7, the mean is 13, and the standard deviation is 3. What is the person's $Z$ score?

A) –2

B) –1

C) 1

D) 2

Answer: A

50) A raw score is equal to the:

A) *Z* score multiplied by the standard deviation, plus the mean

B) *Z* score multiplied by the variance, plus the mean

C) standard deviation multiplied by the mean, plus the variance

D) raw score minus the mean, divided by the variance

Answer: A

51) For a particular group of scores, $M = 20$ and $SD = 5$. What is the *Z* score for a raw score of 10?

A) 2

B) 0

C) –2

D) –1

Answer: C

52) For a particular group of scores, $M = 15$ and $SD = 3$. Provide the raw score for a *Z* score of 7:

A) 15

B) 24

C) 36

D) 48

Answer: C

53) Who was the behavioral psychologist opposed to the use of statistics in psychology?

A) Cohen

B) McCracken

C) Cronbach

D) Skinner

Answer: D

54) A researcher studying the sociological implications of cultural diversity conducts lengthy interviews with members of various cultural communities. What kind of method is this sociologist probably using?

A) Behavioral techniques

B) Quantitative techniques

C) Qualitative techniques

D) Positivistic techniques

Answer: C

55) Although _____ and _____ are often provided in research articles (in the text or tables), _____ are rarely reported.

A) variance, range, *Z* scores

B) *Z* scores, *T* scores, means

C) means, standard deviations, *Z* scores

D) outliers, *Z* scores, means

Answer: C

56) Match the term on the left with its correct definition on the right

| | |
|---|---|
| A) definitional formula | 1) ordinary score (or any other number in a distribution before it has been made into a *Z* score) |
| B) raw score | 2) approximately the average amount that scores in a distribution vary from the mean |
| C) *Z* score | 3) equation for a statistical procedure directly showing the meaning of the procedure |
| D) standard deviation | 4) number of standard deviations a score is above or below the mean of its distribution |

Answer: A-3; B-1; C-4; D-2

57) Whose name is associated with behaviorism and opposition to the field of statistics on the basis that important information may be lost by averaging the results of a number of cases?

A) James

B) Freud

C) Wolpe

D) Skinner

Answer: D

58) Qualitative research techniques are likely to involve each of the following EXCEPT:

A) lengthy interviews

B) focus groups

C) quantitative methods (e.g., statistics)

D) observations of individuals (e.g., in natural settings)

Answer: C

59) A research article states that "At the time of the study, the mean age of first-year college students at Wayne University was 17.6 (3.57). The number in parentheses likely represents:

A) the *Z* score

B) the standard deviation

C) the mode

D) an outlier

Answer: B

60) The ordinary arithmetic average is called the _____.

Answer: mean

61) The mean of the scores 2, 2, 2, 6 is _____.

Answer: 3

62) A group of scores is 6, 7, 7, 8, 10, 11. What is *N*?

Answer: 6

63) The _____ is the value with the most scores.

Answer: mode

64) A group of scores is 2, 2, 4, 8, 9, 2, 10, 15, 30, 30. What is the mode?

Answer: 2

65) A group of scores is 6, 18, 4, 21, 22. _____ is the median.

Answer: 18

66) In statistics, the best measure of the representative value of a group of scores is *usually* the mode. (True or False)

Answer: FALSE

67) In a perfectly symmetrical unimodal distribution, the mode is the same as the mean. (True or False)

Answer: TRUE

68) A group of scores is 2, 2, 4, 8, 9, 25. What is the median?

Answer: 6

69) A group of scores is 2, 81, 82, 82, 84, 86, 90. The number _____ is an outlier.

Answer: 2

70) The variance of a group of scores is the average of the _____.

Answer: squared deviations from the mean, squared deviations

71) The variance of the scores 1, 7, 13 is _____.

Answer: 24

72) A deviation score is the difference between the score and the _____.

Answer: mean

73) The _____ is approximately the average that a score differs from the mean.

Answer: standard deviation

74) The standard deviation is the _____ of the variance.

Answer: square root, positive square root

75) A(n) _____ is the number of standard deviations a score is above or below the mean.

Answer: *Z* score

76) A *Z* score is –3 and the sample's $M = 30$ and $SD = 6$. The raw score is _____.

Answer: 12

77) A raw score is 28, $M = 20$, and $SD = 2$. The *Z* score is _____.

Answer: 4

78) Alex's *Z* score on his abnormal psychology exam was –.05, indicating that he scored well above the mean on the exam. (True or False).

Answer: FALSE

79) The formula for changing a *Z* score to a raw score is _____.

Answer: $X = (Z)(SD) + M$

80) Behaviorists such as B. F. Skinner sometimes object to the use of statistics in research because averages can distort the pattern of information revealed from observing the behavior of _____.

Answer: each individual case

81) List the three most widely used ways to describe a typical or representative value and explain what each tells a researcher.

82) Make up three sets of scores for eight people who took a verbal ability test (test ranges from 20 to 60 points). For one set of scores, the mean should be greater than the median. For the second set of scores, the mean and median should be equivalent. For the third set of scores, the mode should be greater than both the mean and median.

83) Make up an example in which the median would be the preferred measure of the representative value of a group of scores.

84) The tiger at the local zoo lived to the age of 28 while the elephant lived to the age of 65. Explain to someone unfamiliar with statistical techniques which animal lived longer relative to the expected lifespan of its species? Use the information provided below to help answer the question.
Average lifespan of a tiger = 22 (*SD* = 3)
Average lifespan of an elephant = 70 (*SD* = 7)

85) Based on an analysis of personnel records, an organizational specialist reports that for her company: "During the last year, the mean number of sick days taken by shop employees was 7.3 with a standard deviation of 6.1." Explain what this result means to a person who has never had a course in statistics.

86) During the winter, a survey is conducted at a particular college regarding the number of hours spent outside on weekends. The survey reports that for students from cold-weather climates, *M* = 8, *SD* = 1.5. For students from warm-weather climates, *M* = 5, *SD* = 4.2. Explain what these numbers mean and the conclusions one should draw from this study.

87) Here are the average snowfalls (in inches) for a particular northern U.S. city on consecutive February days during the winter of 2007: 0, 0, 2, 2, 4, 5, 0, 0, 6, 15. Describe the representative (typical) snowfall and the amount of variation in this city. Provide three ways of describing the representative snowfall and two ways of describing its variation, explaining differences in how you calculated each value.

88) How might researchers combine quantitative and qualitative methodologies to improve psychological research?

89) Five high school English teachers were given a grammar test. Their scores were as follows: 17, 19, 14, 20, 20.

**Figure the mean, mode, variance, and standard deviation for this sample.**
**Explain what you have done and what the results mean to a person who has never had a course in statistics.**

Answer: *Mean* = 90/5 = 18
*Mode* = 20
*Variance* = 1 + 1 + 16 + 4 + 4 = 26/5 = 5.2
*Standard Deviation* = square root of 5.2 = 2.28

90) A teacher rated the reading ability level of six fourth-grade children participating in a special math program. The ratings were as follows: 3, 3, 2, 8, 4, 4.

**Figure the mean, variance, and standard deviation for this group of scores.**
**Explain what you have done and what the results mean to a person who has never had a course in statistics.**

Answer: *Mean* = 24/6 = 4
*Mode* = bimodal(3 and 4)
*Variance* = 1 + 1 + 4 + 16 + 0 + 0 = 22/6 = 3.67
*Standard Deviation* = square root of 3.67 = 1.92

91) A museum curator was interested in people's responses to art. She therefore had seven people indicate their liking for a particular piece of Egyptian sculpture. Their ratings were as follows: 2, 4, 4, 5, 6, 7, 7.

**Figure the mean, median, mode, variance, and standard deviation for this group of scores.**
**Explain what you have done and what the results mean to a person who has never had a course in statistics.**

Answer: *Mean* = 35/7 = 5
*Median* = 5
*Mode* = bimodal(4 and 7)
*Variance* = 9 + 1 + 1 + 0 + 1 + 4 + 4 = 20/7 = 2.86
*Standard Deviation* = square root of 3.67 = 1.69

92) After attending an anxiety-reduction therapy session, a wife's anxiety score is 75, while her husband's is 80. Overall, women's average anxiety score after the sessions is 70 ($SD$ = 10) and men's average anxiety score after the sessions is 85 ($SD$ = 5).

**Relative to others of their own gender, who has the lower anxiety score after the session? Explain your answer to someone who has never had a course in statistics.**

Answer: Wife's $Z$ = .5; Husband's $Z$ = –1. Thus, wife is more anxious relative to her gender. (Note: Lower score = positive outcome/reduced anxiety. Thus, negative $Z$ scores indicate lower anxiety.)

93) A business researcher has to decide which of three employees should be placed in a particular job that requires a high level of perceptual–motor coordination. All three employees have taken tests of perceptual–motor coordination, but each took a different test.
*Employee A* scored 15 on a test with a mean of 10 and a standard deviation of 2.
*Employee B* scored 350 on a test with a mean of 300 and a standard deviation of 40.
*Employee C* scored 108 on a test with a mean of 100 and a standard deviation of 16.
On all three tests, higher scores mean greater coordination.

**Which employee has the best perceptual–motor coordination?**
**Explain your answer to someone who has never had a course in statistics.**

Answer: Employee A's Z = 2.5; Employee B's Z = 1.25; Employee C's Z = .5.
Thus, Employee A has the best perceptual–motor coordination and should be given the job.

94) A clinical psychologist administered a standard test of symptoms of three different behavioral disorders to a new patient at a mental health clinic. On the scale that measures *Disorder F* (in the general public, $M = 60$, $SD = 8$), the person's score is 62. On the scale that measures *Disorder H* (in the general public, $M = 32$, $SD = .5$), the person's score is 34. And on the scale that measures *Disorder K* (in the general public, $M = 83$, $SD = 12$), the person's score is 89.

**For the symptoms of which disorder or disorders did this person score substantially higher than the general public?**
**Explain your answer to someone who has never had a course in statistics.**

Answer: Disorder F, $Z = .25$; Disorder H, $Z = 4$; Disorder K, $Z = .5$. Thus, only on Disorder H are the person's symptoms substantially higher than for the general public.