

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

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### MULTIPLE CHOICE

- 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 Bloom's Category: Remembering

- 2) The ordinary average of a group of numbers is called the
- A) median.
  - B) mean.
  - C) standard deviation.
  - D) mode.

Answer: B Bloom's Category: Remembering

- 3) The rule for calculating the mean is to add 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 Bloom's Category: Remembering

- 4) 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 Bloom's Category: Remembering

- 5) The most common single number in a group of scores is the
- A) mode.
  - B) mean.
  - C) median.
  - D) average.

Answer: A Bloom's Category: Remembering

- 6) The middle value in a set of scores ordered from lowest to highest is the
- A) mean.
  - B) mode.
  - C) average.
  - D) median.

Answer: D      Bloom's Category: Remembering

- 7) 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 investigator would probably decide to indicate the typical value by reporting the
- A) mean.
  - B) median.
  - C) mode.
  - D) standard deviation.

Answer: B      Bloom's Category: Applying

- 8) 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      Bloom's Category: Understanding

- 9) The capital Greek letter "sigma" is the symbol for
- A) "average of."
  - B) "sum of."
  - C) "variance of."
  - D) "median of."

Answer: B      Bloom's Category: Remembering

- 10) 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      Bloom's Category: Remembering

- 11) The mode can be a poor representative value because
- A) it can be difficult to calculate without a statistical software package.
  - B) it may not reflect many aspects of the distribution.
  - C) it is generally larger than the mean.

D) it is generally larger than the median.

Answer: B      Bloom's Category: Remembering

- 12) The statistic usually used to describe the representative value for a nominal variable such as religious affiliation is the

A) mean.  
B) outlier.  
C) median.  
D) mode.

Answer: D      Bloom's Category: Remembering

- 13) 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      Bloom's Category: Remembering

- 14) Behavioral and social scientists generally use the mean as the measure of the representative value of a group of scores unless there are

A) outliers.  
B) histograms.  
C) Z scores.  
D) two modes.

Answer: A      Bloom's Category: Remembering

- 15) While the mean provides a representative value of a group of scores, it does not describe 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      Bloom's Category: Remembering

16) 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 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      Bloom's Category: Remembering

17) 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      Bloom's Category: Remembering

18) 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      Bloom's Category: Remembering

19) In a class of students in which everyone is 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      Bloom's Category: Remembering

20) 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      Bloom's Category: Remembering

21) 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      Bloom's Category: Remembering

22) The standard deviation is the average amount that scores differ from the

- A) histogram.
- B) median.
- C) mean.
- D) range.

Answer: C      Bloom's Category: Remembering

23) 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      Bloom's Category: Remembering

24) 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) outliers.

Answer: D      Bloom's Category: Remembering

25) 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 is the best interpretation of these numbers?

- 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      Bloom's Category: Analyzing

26) In a distribution of Z scores, the mean is always

- A) 10.
- B) 1.
- C) 0.
- D) 50.

Answer: C      Bloom's Category: Remembering

27) The statistic that describes a particular score in terms of where it fits into an overall group of scores is the

- A) standard deviation.
- B) computational formula.
- C) Z score.
- D) Q score.

Answer: C      Bloom's Category: Remembering

28) 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      Bloom's Category: Remembering

29) A student's score on a statistics test was +1.25, which means that the score was

- 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      Bloom's Category: Understanding

30) 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      Bloom's Category: Remembering

31) All of the following are advantages of Z scores EXCEPT

- 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      Bloom's Category: Remembering

- 32) 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      Bloom's Category: Remembering
- 33) Who was the behavioral psychologist who opposed the use of statistics in psychology?
- A) Cohen
  - B) McCracken
  - C) Cronbach
  - D) Skinner
- Answer: D      Bloom's Category: Remembering
- 34) A sociologist studying the sociological implications of cultural diversity conducts lengthy interviews with members of various cultural communities. The sociologist is using a
- A) behavioral technique.
  - B) quantitative technique.
  - C) qualitative technique.
  - D) positivistic technique.
- Answer: C      Bloom's Category: Remembering
- 35) The two statistics most likely to be presented in a research article are the
- A) the mode and the variance.
  - B) the mean and the standard deviation.
  - C) the median and the standard deviation.
  - D) the mean and the variance.
- E) Answer: B      Bloom's Category: Remembering
- 36) Qualitative research techniques are likely to involve all 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      Bloom's Category: Understanding
- 37) 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      Bloom's Category: Remembering

## SENTENCE COMPLETION/TRUE-FALSE

38) The ordinary arithmetic average is called the \_\_\_\_\_.

Answer: mean      Bloom's Category: Remembering

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

Answer: 6      Bloom's Category: Remembering

40) The value with the most scores is the \_\_\_\_\_.

Answer: mode      Bloom's Category: Remembering

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

Answer: FALSE      Bloom's Category: Remembering

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

Answer: TRUE      Bloom's Category: Remembering

43) In a group of scores of 2, 81, 82, 82, 84, 86, 90, the outlier is \_\_\_\_\_.

Answer: 2      Bloom's Category: Remembering

44) The variance of a group of scores is the average of the \_\_\_\_\_.

Answer: squared deviations from the mean, squared deviations  
Bloom's Category: Remembering

45) A deviation score is the difference between the score and the \_\_\_\_\_.

Answer: mean      Bloom's Category: Remembering

46) The standard deviation is the \_\_\_\_\_ of the variance.

Answer: square root, positive square root      Bloom's Category: Remembering

47) The number of standard deviations a score is above or below the mean can be indicated by a \_\_\_\_\_.

Answer: Z score      Bloom's Category: Remembering

48) A student's Z score on an abnormal psychology exam was  $-.05$ , indicating that the student scored above the mean on the exam. (True or False)

Answer: FALSE      Bloom's Category: Applying

49) The formula for changing a Z score to a raw score is \_\_\_\_\_.

Answer:  $X = (Z)(SD) + M$       Bloom's Category: Remembering

- 50) 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      Bloom's Category: Remembering

### SHORT ANSWER/CONCEPT APPLICATION

- 51) A sociologist 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?

Answer: 7      Bloom's Category: Applying

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

Answer: 14      Bloom's Category: Applying

- 53) Based on the scores 1, 9, 3, 6, 1, 2, 6, 2, 2, 8, a score of 4 is the \_\_\_\_\_. Answer: mean      Bloom's Category: Applying

- 54) 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

Answer: C      Bloom's Category: Analyzing

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

Answer: 10      Bloom's Category: Applying

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

Answer: mode      Bloom's Category: Applying

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

Answer: 4      Bloom's Category: Applying

- 58) In the following set of scores, 1, 2, 3, 4, 5, 5, 7, 8, 9, 10, 12, 12, 13, what is the relationship between the mean, median, and mode?

Answer: the mode is greater than either the median or the mean, which are approximately equal      Bloom's Category: Analyzing

- 59) What is the variance of scores of 1, 4, 7?  
Answer: 6      Bloom's Category: Analyzing
- 60) What is the variance of scores of 0, 1, 1, 2?  
Answer: 0.5      Bloom's Category: Analyzing
- 61) What is the standard deviation of scores of 2, 4, 3, 7?  
Answer: 1.87      Bloom's Category: Analyzing
- 62) For questions 46 and 47: Statistics student A wants to compare his final exam score to Student B's final exam score from last year. However, the two exams were scored on different scales. Student A asks Student B for the mean and standard deviation of her class on the exam as well as her final exam score. Compute the  $Z$  scores for both students.  
Student A: Final exam score = 85; Class:  $M = 70$ ;  $SD = 10$   
Student B: Final exam score = 45; Class:  $M = 35$ ;  $SD = 5$   
Answer: Student A,  $Z = 1.50$ ; Student B,  $Z = 2.00$       Bloom's Category: Applying
- 63) In relation to the other people in their classes, who had the better exam score?  
Answer: Student B      Bloom's Category: Understanding
- 64) If a  $Z$  score of 2.0 was calculated from a distribution with a mean of 80 and a standard deviation of 10, the raw score was  
Answer: 100      Bloom's Category: Applying
- 65) A person's raw score is 7, the mean is 13, and the standard deviation is 3. What is the person's  $Z$  score?  
Answer: -2      Bloom's Category: Applying
- 66) For a certain group of scores,  $M = 20$  and  $SD = 5$ . What is the  $Z$  score for a raw score of 10?  
Answer: -2      Bloom's Category: Applying
- 67) For a certain group of scores,  $M = 15$  and  $SD = 3$ . What is the raw score for a  $Z$  score of 7:  
Answer: 36      Bloom's Category: Applying
- 68) What is the mean of the scores 2, 2, 2, 6?  
Answer: 3      Bloom's Category: Analyzing
- 69) A group of scores is 2, 2, 4, 8, 9, 2, 10, 15, 30, 30. What is the mode?  
Answer: 2      Bloom's Category: Analyzing
- 70) In a group of scores of 6, 18, 4, 21, 22, what is the median?  
Answer: 18      Bloom's Category: Analyzing

- 71) In a group of scores of 2, 2, 4, 8, 9, 25, what is the median?  
Answer: 6      Bloom's Category: Analyzing
- 72) What is the variance of the scores 1, 7, 13?  
Answer: 24      Bloom's Category: Analyzing
- 73) If a  $Z$  score is  $-3$  and the sample's  $M = 30$  and  $SD = 6$ , the raw score is  
Answer: 12      Bloom's Category: Analyzing
- 74) If a raw score is 28,  $M = 20$ , and  $SD = 2$ . The  $Z$  score is \_\_\_\_\_.  
Answer: 4      Bloom's Category: Analyzing
- 75) List the three most widely used ways to describe a typical or representative value and explain what each tells a social scientist.  
Bloom's Category: Remembering
- 76) 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.  
Bloom's Category: Creating
- 77) Make up an example in which the median would be the preferred measure of the representative value of a group of scores.  
Bloom's Category: Creating
- 78) What is the relationship between the median and the mean in a distribution that is skewed to the right?  
Bloom's Category: Understanding
- 79) 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 ( $SD = 7$ )  
Bloom's Category: Understanding
- 80) Based on an analysis of personnel records, an organizational specialist reports for a company that: "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.  
Bloom's Category: Understanding

- 81) During the winter, a survey is conducted at a 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 the meaning of these statistics and the conclusions one can draw from this study.

Bloom's Category: Understanding

- 82) The average snowfalls (in inches) for a northern U.S. city on consecutive February days during the winter of 2007 were: 0, 0, 2, 2, 4, 5, 0, 0, 6, 15. Describe the representative (typical) snowfall and the amount of variation in this city.

Bloom's Category: Understanding

- 83) Provide three ways of describing the representative snowfall and two ways of describing its variation, explaining differences in how you calculated each value.

Bloom's Category: Understanding

- 84) How might social scientists combine quantitative and qualitative methodologies to improve psychological research?

Bloom's Category: Understanding

- 85) 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.**

Bloom's Category: Analyzing

**Explain what you have done and what the results mean to a person who has never had a course in statistics.**

Bloom's Category: Understanding

Answer:  $Mean = 90/5 = 18$

$Mode = 20$

$Variance = 1 + 1 + 16 + 4 + 4 = 26/5 = 5.2$

$Standard Deviation = \text{square root of } 5.2 = 2.28$

- 86) 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.**

Bloom's Category: Analyzing

**Explain what you have done and what the results mean to a person who has never had a course in statistics.**

Bloom's Category: Understanding

Answer:  $Mean = 24/6 = 4$

$Mode = \text{bimodal (3 and 4)}$

$Variance = 1 + 1 + 4 + 16 + 0 + 0 = 22/6 = 3.67$

$Standard Deviation = \text{square root of } 3.67 = 1.92$

- 87) A museum curator interested in people's responses to art had seven people indicate their liking for a 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.**

Bloom's Category: Analyzing

**Explain what you have done and what the results mean to a person who has never had a course in statistics.**

Bloom's Category: Understanding

Answer:  $Mean = 35/7 = 5$

$Median = 5$

$Mode = \text{bimodal (4 and 7)}$

$Variance = 9 + 1 + 1 + 0 + 1 + 4 + 4 = 20/7 = 2.86$

$Standard Deviation = \text{square root of } 3.67 = 1.69$

- 88) After attending an anxiety-reduction therapy session, a wife's anxiety score is 75, while her husband's score 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?**

Bloom's Category: Analyzing

**Explain your answer to someone who has never had a course in statistics.**

Bloom's Category: Understanding

Answer: Wife's  $Z = .5$ ; Husband's  $Z = -1$ . Thus, wife is more anxious relative to her gender.

- 89) A business manager must 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?**

Bloom's Category: Analyzing

**Explain your answer to someone who has never had a course in statistics.**

Bloom's Category: Understanding

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.

- 90) 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. Finally, on the scale that measures *Disorder K* (in the general public,  $M = 83$ ,  $SD = 12$ ), the person's score is 89.

**For which disorder or disorders did this person demonstrate a substantially higher number of symptoms than the general public?**

Bloom's Category: Analyzing

**Explain your answer to someone who has never had a course in statistics.**

Bloom's Category: Understanding

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.