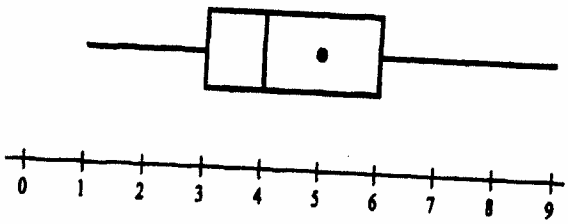
# CHAPTER 4

## Other Descriptive Statistics

**Summary**

This chapter covers *z* scores, box plots, the effect size index and the Descriptive Statistics Report. The first three are descriptive statistics that combine two or more simpler descriptive statistics. A Descriptive Statistics Report presents several statistics about a data set as well as an explanation of what the statistics mean.

A *z score* (also called a standardized score) is the difference between a raw score and the mean of the distribution divided by the standard deviation of the distribution. z scores are used to compare the relative positions of scores within one distribution or the relative position of scores in different distributions, and allow us to make a comparison between different populations by using a common metric. Typically, descriptive statistic *z* scores range from –3 to +3. As an inferential statistic, however, *z* scores can occur outside this range.




There are two parts to a *boxplot* (see above). The first, a horizontal axis, shows all the scores in a distribution. The second, a box with whiskers, has elements that correspond to various descriptive statistics. Elements of the box and whiskers are aligned over their corresponding values on the horizontal axis. Within the box, the mean is indicated by a dot; the median by a vertical line. The width of the box from left to right spans the interquartile range. The ends of the whiskers are over the lowest and highest scores in the distribution. The skew of the distribution can be determined by the relation of the mean to the median and also by comparing the relative length of the whiskers.

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The *effect size index* (*d*) describes the amount of difference between two distributions. Effect size estimates are often used to help researchers understand the amount of influence the independent variable has on the dependent variable. To find *d*, divide the difference between the means of the two distributions by a standard deviation. Values of *d* are judged by a convention that assigns the descriptors, "small", "medium", and "large" to values of .20, .50, and .80, respectively. Adjectives are used to modify the descriptors for intermediate and extreme values of *d*.

For an experiment that compares two groups, a *Descriptive Statistics Report* gives the reader an overview of the results. It consists of a boxplot and a narrative. A Descriptive Statistics Report typically reports means, medians, ranges, IQR's, skew, and an effect size index. The major purpose of a Descriptive Statistics Report is to explain to the reader what an experiment revealed.

## Multiple-Choice Questions

1. A *z* score conveys the
   (1) central tendency of a distribution;
   (2) variability of a distribution;
   (3) relative position of an individual;
   (4) all of the above.

2. A *z* score close to zero indicates
   (1) a raw score near the bottom of the distribution;
   (2) a raw score close to the mean;
   (3) a distribution with little variability;
   (4) a distribution that is quite variable.

3. A *z* score of 2.5 indicates
   (1) a raw score close to the mean;
   (2) a raw score that is much smaller than the mean;
   (3) a raw score that is much larger than the mean;
   (4) a raw score that is 2.5 times larger than the mean .

4. The advantage of using $z$ scores over using raw scores is that z scores allow you to
   (1) compare a score in one distribution to a score in another;
   (2) understand the relationship of a score to the mean;
   (3) both (1) and (2);
   (4) neither (1) nor (2).

5. For four years in a row at the annual Late 90's Video Game Contest, a different entrant won the contest. The field of contestants was different each year. Each year's winners, amount of time they were able to play, and contest statistics are shown. Who was the overall winner?
   (1) Year 1: Zach, 32 hours; $\overline{X} = 28$ hours; S = 2 hours;
   (2) Year 2: Slater, 34 hours; $\overline{X} = 29$ hours; S = 2 hours;
   (3) Year 3: Screech, 36 hours; $\overline{X} = 30$ hours; S = 6 hours;
   (4) Year 4: Lisa, 28 hours; $\overline{X} = 24$ hours; S = 3 hours.

6. The number of descriptive statistics conveyed by a boxplot is
   (1) one;
   (2) two;
   (3) three;
   (4) more than three.

7. A boxplot of a negatively skewed distribution has a whisker over the lower scores that is
   _____ than the whisker over the higher scores.
   (1) longer;
   (2) shorter;
   (3) unable to determine.

8. In a boxplot of a positively skewed distribution, the mean is
   (1) greater than the median;
   (2) less than the median;
   (3) out of the interquartile box;
   (4) in the middle of the interquartile box.

9. To determine the range of a distribution using a boxplot, look at.
   (1) the difference between the dot and the line in the box;
   (2) the ends of the box;
   (3) the ends of the whiskers;
   (4) any of the above will work.

10. Ouliers (extreme scores) can be presented in a boxplot as points
   (1) within the box;
   (2) above the box;
   (3) below the box;
   (4) beyond the whiskers.

11. The measure of central tendency that is not presented in a boxplot is the
   (1) mean;
   (2) median;
   (3) mode;
   (4) all of the above.

12. The percent of frequencies covered by the box portion of a boxplot is
   (1) 100 percent;
   (2) 95 percent;
   (3) 50 percent;
   (4) 5 percent.

13. Group A's mean was a whopping 110, but it was exceeded by Group B's mean of 114. The effect size index in this contest was 0.20. The difference between the two groups should be described as
   (1) very large;
   (2) large;
   (3) medium;
   (4) small.

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14. From an effect size estimate of 0.70, you can determine that the means of the two groups are
    (1) identical;
    (2) different by 70 percent;
    (3) related to each other;
    (4) very different.

15. An effect size index is a measure of
    (1) the relative position of an individual;
    (2) the effectiveness of a Descriptive Statistics Report;
    (3) the accuracy of the calculations;
    (4) none of the above.

16. An effect size index is measure of
    (1) the size of the means of the two distributions;
    (2) the difference in the means of the two distributions;
    (3) the size of the standard deviations of the two distributions;
    (4) the size of the ranges of the two distributions.

17. An experiment compared two groups. The effect size index was just less than 1.00. The difference between the two groups is
    (1) large;
    (2) medium;
    (3) small;
    (4) very small.

18. The effect size estimate, *d,* is a useful measure because it
    (1) provides new information about the relationship between two groups;
    (2) shows the effect the independent variable has on the dependent variable;
    (3) it allows direct comparisons to other studies;
    (4) all are true.

19. A Descriptive Statistics Report has information about
    (1) central tendency;
    (2) variability;
    (3) effect size index;
    (4) all of the above.

20. The purpose of a Descriptive Statistics Report is to
    (1) avoid arithmetic errors in reporting descriptive statistics;
    (2) present tables that show descriptive statistics;
    (3) explain the results of a two-group experiment;
    (4) present results without using graphs.

## Short-Answer Questions

1. What does a $z$ of 0 equal in a distribution of raw scores?
2. Write from memory the $d$ values that are considered small, medium, and large.
3. What descriptive statistics are presented in a boxplot?

## Problems

1. For Problems 3b and 3 in Chapters 2 and 3, you analyzed data from a memory span study. Using those analyses, create a boxplot. Write an explanation of what the boxplot shows.

2. You analyzed the age at which babies are first able to stand alone in Chapter 3 (Problem 6). Create a boxplot using your analysis. Write an explanation for parents who understand boxplots.

3. For the data on weights of 20-29 year-old Americans, compose a boxplot, calculate the effect size index, and write a Descriptive Statistics Report. ($\overline{X}_{\text{Men}} = 180$ pounds; $\overline{X}_{\text{Women}} = 145$ pounds; $\sigma = 40$ pounds) Work from the grouped frequency distributions and statistics you calculated in Problems 4 and 7 in Chapters 2 and 3 respectively.

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4. Compose a boxplot, calculate the effect size index, and write a Descriptive Statistics Report for the 1984 and 2004 human birthweight data (Problem 4 Chapter 3). Let $\sigma = 1.25$ pounds.

5. The question in this problem is the same as one in your text, "Just how different in cognitive ability are first and second born siblings?" Breland (1974) collected data on cognitive ability from National Merit Scholarship participants. For two children families, the mean of first-born children was 107.5; for second-born children, the mean was 105.5. The standard deviation was 21. Find the effect size index. Write a sentence of interpretation that incorporates the results described in the textbook problem.

6. The average score on an IQ test is 100, and the standard deviation is 15. What *z* score corresponds to raw scores of

   a.115 b.124 c.97
   d.101 e. 87

7. Assume the same characteristics of IQ scores as those given in Question 6. What raw score corresponds to *z* scores of

   a. -.533 b. 1.40 c. 2.73
   d. -1.93