To determine whether the test was significant, examine the table labeled Paired-Samples Test. The test is significant, $t(29) = 2.83$, $p < .01$. The $p$ value is located in the column labeled Sig. Because the $p$ value is less than .05, we reject the null hypothesis that the population mean difference is equal to 0 at the .05 level.

Using SPSS Graphs to Display the Results

Graphs are useful for illustrating not only the differences between means but also the overlap of the two distributions. For the paired-samples $t$ test, error bar charts or boxplots of the paired variables could be used. A histogram of the difference scores could also be used. In Figure 144, we present the results of the pay and security ratings with boxplots. To create these boxplots, follow these steps:

1. Click Graphs, click Legacy Dialogs, and then click Boxplot.
2. Click Simple, then click Summaries of separate variables. Click Define in the Boxplots dialog box.
3. Holding down the Ctrl key, click pay and security, and click $\uparrow$ to move them to the Boxes Represent.
4. Click OK. The edited graph is shown in Figure 144.

![Figure 144. Boxplots of pay and security ratings.](image)

An APA Results Section

A paired-samples $t$ test was conducted to evaluate whether employees were more concerned with pay or job security. The results indicated that the mean concern for pay ($M = 5.67$, $SD = 1.49$) was significantly greater than the mean concern for security ($M = 4.50$, $SD = 1.83$), $t(29) = 2.83$, $p < .01$. The standardized effect size index, $d$, was .52, with considerable overlap in the distributions for the 10-point Likert ratings of pay and security, as shown in Figure 144. The 95% confidence interval for the mean difference between the two ratings was .32 to 2.01.

Alternative Analyses

Data for a paired-samples $t$ test can be analyzed by using a repeated-measures analysis of variance (see Lesson 29). The paired-samples $t$ test and the repeated-measures ANOVA yield identical results in that the $p$ values associated with the two tests are always the same. The advantage
of the repeated-measures ANOVA over the paired-samples $t$ test is that the former computes the effect size statistic, $\eta^2$ (labeled Eta Squared).

Data for a paired-samples $t$ test also can be analyzed with the use of nonparametric procedures. (See Lesson 44.) Nonparametric procedures may be considered if the population distribution of the difference scores is not normal.

### Exercises

The data for Exercises 1 through 5 are in the data set named *Lesson 2.3 Exercise File 1* on the Web at [http://www.pearsonhighered.com/greensalkindSPSS](http://www.pearsonhighered.com/greensalkindSPSS). The data are from the following research problem.

Mike, a developmental psychologist, wants to know if overall life stress increases or decreases as working women grow older. He obtains scores on the ILS (Index of Life Stress) from a group of 100 working women when they are 40 years of age. He is able to obtain a second ILS from 45 of these women at age 60 to assess whether they felt significantly more or less stress as they grew older. The ILS consists of two scores, interpersonal life stress and occupational life stress. The two scores combine to form an index of overall life stress. The SPSS data file contains 45 cases, one for each woman, and four variables, their interpersonal and occupational life stress at age 40 and their interpersonal and occupational life stress at age 60.

1. Compute scores to obtain a total Index of Life Stress (ILS) at age 40 and age 60.
2. Compute a paired-samples $t$ test to determine if overall life stress increases or decreases with age.
3. Create a difference variable to show the changes in life stress from 40 years of age to 60 years of age for each woman. Create a histogram to show these changes graphically.
4. Mike decides that an overall ILS does not adequately reflect changes in women's life stress over time. He hypothesizes that occupational stress probably declines as women get older, while interpersonal life stress may increase or stay the same. Conduct paired-samples $t$ tests to evaluate these hypotheses.
5. Write a Results section based on your analyses in Exercises 1 through 4. Be sure to include graphical and statistical descriptions in your results.

The data for Exercises 6 through 8 are in the data set named *Lesson 2.3 Exercise File 2* on the Web at [http://www.pearsonhighered.com/greensalkindSPSS](http://www.pearsonhighered.com/greensalkindSPSS). The data are from the following research problem.

Kristy is interested in investigating whether husbands and wives who are having infertility problems feel equally anxious. She obtains the cooperation of 24 infertile couples. She then administers the Infertility Anxiety Measure (IAM) to both the husbands and the wives. Her SPSS data file contains 24 cases, one for each husband–wife pair, and two variables, the IAM scores for the husbands and the IAM scores for the wives.

6. Conduct a paired-samples $t$ test on these data. On your output, identify the following:
   a. mean IAM score for husbands
   b. mean IAM score for wives
   c. $t$ test value
   d. $p$ value
7. Write a Results section in APA style based on your output.
8. If you did not include a graph in your Results section, create a boxplot to show the differences between husbands’ and wives’ IAM scores.