

loaded manually or by an automatic feed system. The following data give the numbers of defective parts produced. Use $\alpha = .05$ to test for any significant effect due to machine, loading system, and interaction.

	Loading System	
	Manual	Automatic
Machine 1	30 34	30 26
Machine 2	20 22	24 28

Case Problem 1 Wentworth Medical Center

As part of a long-term study of individuals 65 years of age or older, sociologists and physicians at the Wentworth Medical Center in upstate New York investigated the relationship between geographic location and depression. A sample of 60 individuals, all in reasonably good health, was selected; 20 individuals were residents of Florida, 20 were residents of New York, and 20 were residents of North Carolina. Each of the individuals sampled was given a standardized test to measure depression. The data collected follow; higher test scores indicate higher levels of depression. These data are contained in the file Medical1.

A second part of the study considered the relationship between geographic location and depression for individuals 65 years of age or older who had a chronic health condition such as arthritis, hypertension, and/or heart ailment. A sample of 60 individuals with such conditions was identified. Again, 20 were residents of Florida, 20 were residents of New York, and 20 were residents of North Carolina. The levels of depression recorded for this study follow. These data are contained in the file named Medical2.

WEB file
Medical1

WEB file
Medical2

Data from Medical1			Data from Medical2		
Florida	New York	North Carolina	Florida	New York	North Carolina
3	8	10	13	14	10
7	11	7	12	9	12
7	9	3	17	15	15
3	7	5	17	12	18
8	8	11	20	16	12
8	7	8	21	24	14
8	8	4	16	18	17
5	4	3	14	14	8
5	13	7	13	15	14
2	10	8	17	17	16
6	6	8	12	20	18
2	8	7	9	11	17
6	12	3	12	23	19
6	8	9	15	19	15
9	6	8	16	17	13
7	8	12	15	14	14
5	5	6	13	9	11
4	7	3	10	14	12
7	7	8	11	13	13
3	8	11	17	11	11

Managerial Report

1. Use descriptive statistics to summarize the data from the two studies. What are your preliminary observations about the depression scores?
2. Use analysis of variance on both data sets. State the hypotheses being tested in each case. What are your conclusions?
3. Use inferences about individual treatment means where appropriate. What are your conclusions?

Case Problem 2 Compensation for Sales Professionals

Suppose that a local chapter of sales professionals in the greater San Francisco area conducted a survey of its membership to study the relationship, if any, between the years of experience and salary for individuals employed in inside and outside sales positions. On the survey, respondents were asked to specify one of three levels of years of experience: low (1–10 years), medium (11–20 years), and high (21 or more years). A portion of the data obtained follow. The complete data set, consisting of 120 observations, is contained in the file named SalesSalary.

WEB file
SalesSalary

Observation	Salary \$	Position	Experience
1	53938	Inside	Medium
2	52694	Inside	Medium
3	70515	Outside	Low
4	52031	Inside	Medium
5	62283	Outside	Low
6	57718	Inside	Low
7	79081	Outside	High
8	48621	Inside	Low
9	72835	Outside	High
10	54768	Inside	Medium
.	.	.	.
.	.	.	.
.	.	.	.
115	58080	Inside	High
116	78702	Outside	Medium
117	83131	Outside	Medium
118	57788	Inside	High
119	53070	Inside	Medium
120	60259	Outside	Low

Managerial Report

1. Use descriptive statistics to summarize the data.
2. Develop a 95% confidence interval estimate of the mean annual salary for all salespersons, regardless of years of experience and type of position.
3. Develop a 95% confidence interval estimate of the mean salary for inside salespersons.
4. Develop a 95% confidence interval estimate of the mean salary for outside salespersons.
5. Use analysis of variance to test for any significant differences due to position. Use a .05 level of significance, and for now, ignore the effect of years of experience.

6. Use analysis of variance to test for any significant differences due to years of experience. Use a .05 level of significance, and for now, ignore the effect of position.
7. At the .05 level of significance test for any significant differences due to position, years of experience, and interaction.

Appendix 13.1 Analysis of Variance with Minitab

Completely Randomized Design

In Section 13.2 we showed how analysis of variance could be used to test for the equality of k population means using data from a completely randomized design. To illustrate how Minitab can be used for this type of experimental design, we show how to test whether the mean number of units produced per week is the same for each assembly method in the Chemitech experiment introduced in Section 13.1. The sample data are entered into the first three columns of a Minitab worksheet; column 1 is labeled A, column 2 is labeled B, and column 3 is labeled C. The following steps produce the Minitab output in Figure 13.5.



- Step 1.** Select the **Stat** menu
- Step 2.** Choose **ANOVA**
- Step 3.** Choose **One-way (Unstacked)**
- Step 4.** When the One-way Analysis of Variance dialog box appears:
 Enter C1-C3 in the **Responses (in separate columns)** box
 Click **OK**

Randomized Block Design

In Section 13.4 we showed how analysis of variance could be used to test for the equality of k population means using the data from a randomized block design. To illustrate how Minitab can be used for this type of experimental design, we show how to test whether the mean stress levels for air traffic controllers are the same for three work stations using the data in Table 13.5. The blocks (controllers), treatments (system), and stress level scores shown in Table 13.5 are entered into columns C1, C2, and C3 of a Minitab worksheet, respectively. The following steps produce the Minitab output corresponding to the ANOVA table shown in Table 13.8.



- Step 1.** Select the **Stat** menu
- Step 2.** Choose **ANOVA**
- Step 3.** Choose **Two-way**
- Step 4.** When the Two-way Analysis of Variance dialog box appears:
 Enter C3 in the **Response** box
 Enter C2 in the **Row factor** box
 Enter C1 in the **Column factor** box
 Select **Fit Additive Model**
 Click **OK**

The treatments are entered in the Row factor box and the blocks are entered in the Column factor box.

Factorial Experiment

In Section 13.5 we showed how analysis of variance could be used to test for the equality of k population means using data from a factorial experiment. To illustrate how Minitab can be used for this type of experimental design, we show how to analyze the data for the two-factor GMAT experiment introduced in that section. The GMAT scores

