**18. Before/After Treatment Results** Captopril is a drug designed to lower systolic blood pressure. When subjects were treated with this drug, their systolic blood pressure readings (in mm Hg) were measured before and after the drug was taken. Results are given in the accompanying table (based on data from "Essential Hypertension: Effect of an Oral Inhibitor of Angiotensin-Converting Enzyme," by MacGregor et al., *British Medical Journal*, Vol. 2). Using a 0.01 significance level, is there sufficient evidence to support the claim that Captopril is effective in lowering systolic blood pressure?

| Subject | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Before | 200 | 174 | 198 | 170 | 179 | 182 | 193 | 209 | 185 | 155 | 169 | 210 |
| After | 191 | 170 | 177 | 167 | 159 | 151 | 176 | 183 | 159 | 145 | 146 | 177 |

**19. Hypnotism for Reducing Pain** A study was conducted to investigate the effectiveness of hypnotism in reducing pain. Results for randomly selected subjects are given in the accompanying table (based on "An Analysis of Factors That Contribute to the Efficacy of Hypnotic Analgesia," by Price and Barber, *Journal of Abnormal Psychology*, Vol. 96, No. 1). The values are before and after hypnosis; the measurements are in centimeters on a pain scale. Construct a 95% confidence interval for the mean of the "before/after" differences. Does hypnotism appear to be effective in reducing pain?

| Subject | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| Before | 6.6 | 6.5 | 9.0 | 10.3 | 11.3 | 8.1 | 6.3 | 11.6 |
| After | 6.8 | 2.4 | 7.4 | 8.5 | 8.1 | 6.1 | 3.4 | 2.0 |

**20. Forecast and Actual Temperatures** The author recorded actual temperatures (°F) along with the temperatures (°F) that were predicted five days earlier. Results are listed below. Construct a 99% confidence interval estimate of the mean of the population of all "actual/forecast" differences. What does the result suggest about the accuracy of the forecast temperatures?

| Date | 9/1 | 9/5 | 9/12 | 9/15 | 9/22 | 9/23 | 9/27 | 9/30 |
|---|---|---|---|---|---|---|---|---|
| Actual High | 80 | 73 | 78 | 73 | 82 | 81 | 74 | 62 |
| High Forecast Five Days Earlier | 80 | 79 | 79 | 78 | 73 | 79 | 70 | 69 |

**Large Data Sets.** ***In Exercises 21–24, use the indicated Data Sets from Appendix B. Assume that the paired sample data are simple random samples and the differences have a distribution that is approximately normal.***

**21. Oscars** Use the sample data from Data Set 11 in Appendix B to test for a difference between the ages of actresses and actors when they win Oscars. Use a significance level of $\alpha = 0.05$.

**22. Body Temperatures** Use the sample data from 8 A.M. and 12 A.M. on Day 1 as listed in Data Set 3 in Appendix B. Test the claim that there is no difference between body temperatures measured at 8 A.M. and at 12 A.M. Use a 0.05 significance level.

**23. Speaking Couples** Use the data in the first two columns of Data Set 17 in Appendix B. Those columns list the numbers of words spoken in a day by each member of 56 different couples. Use a 0.05 significance level.