38. Arrival Delays Refer to Data Set 15 in Appendix B. A flight is considered on time if it arrives no later than 15 minutes after the scheduled arrival time. The last column of Data Set 15 lists arrival delays, so on-time flights correspond to values in that column that are 15 or less. Use the data to construct a 90% confidence interval estimate of the population percentage of on-time flights. Does the confidence interval describe the percentage of on-time flights for all American Airlines flights? Why or why not?

7-2 Beyond the Basics

39. Finite Population Correction Factor For Formulas 7-2 and 7-3 we assume that the population is infinite or very large and that we are sampling with replacement. When we have a relatively small population with size N and sample without replacement, we modify E to include the *finite population correction factor* shown here, and we can solve for n to obtain the result given here. Use this result to repeat Exercise 33, assuming that we limit our population to 200 particular passengers on a Boeing 757-200 ER aircraft.

$$E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}\sqrt{\frac{N-n}{N-1}} \qquad n = \frac{N\hat{p}\hat{q}[z_{\alpha/2}]^2}{\hat{p}\hat{q}[z_{\alpha/2}]^2 + (N-1)E^2}$$

40. Confidence Interval from Small Sample Special tables are available for finding confidence intervals for proportions involving small numbers of cases, where the normal distribution approximation cannot be used. For example, given $x = 3$ successes among $n = 8$ trials, the 95% confidence interval found in *Standard Probability and Statistics Tables and Formulae* (CRC Press) is $0.085 < p < 0.755$. Find the confidence interval that would result if you were to incorrectly use the normal distribution as an approximation to the binomial distribution. Are the results reasonably close?

41. Interpreting Confidence Interval Limits Repeat Exercise 38 using a 99% confidence level. What is unusual about the result? Does common sense suggest a modification of the result?

42. Coping with No Success According to the *Rule of Three,* when we have a sample size n with $x = 0$ successes, we have 95% confidence that the true population proportion has an upper bound of $3/n$. (See "A Look at the Rule of Three," by Jovanovic and Levy, *American Statistician,* Vol. 51, No. 2.)

a. If n independent trials result in no successes, why can't we find confidence interval limits by using the methods described in this section?

b. If 40 couples use a method of gender selection and each couple has a baby girl, what is the 95% upper bound for p, the proportion of all babies who are boys?

43. One-Sided Confidence Interval A one-sided claim about a population proportion is a claim that the proportion is less than (or greater than) some specific value. Such a claim can be formally addressed using a *one-sided confidence interval* for p, which can be expressed as $p < \hat{p} + E$ or $p > \hat{p} - E$, where the margin of error E is modified by replacing $z_{\alpha/2}$ with z_{α}. (Instead of dividing α between two tails of the standard normal distribution, put all of it in one tail.) Repeat part (c) of Example 3 by constructing an appropriate one-sided 95% confidence interval.