

**Section 32.1**

4. A sample of size 20 cannot be expected to give a good confidence interval. Using the  $\frac{1}{\sqrt{n}}$  rule of thumb, the  $\pm \frac{1}{\sqrt{20}} \approx \pm 22\%$  gives a confidence interval covering 44%.
5. Low bias and high precision, because both conditions allow one to be more confident of the sample statistics.
6. Using the  $\frac{1}{\sqrt{n}}$  rule of thumb, there is a good chance that the population proportion lies in the interval  $54\% \pm \frac{1}{\sqrt{400}} = 54\% \pm \frac{1}{20} = 54\% \pm 5\%$ , or 49% to 59%. (Instructor only)
7.
  - a. Using the thumbnail estimate,  $1/\sqrt{1631}$  is about 1/40, or about 0.025, or 2.5%, so the population parameter should be between 50.5% and 55.5%. Hence, it is very likely that the people will not vote for funding a new library.
  - b. But with 100 people, 1/10 is 0.1, so we can assume that the number of people voting against the library measure will be between 43% and 63%.
  - c. However, if the sample statistic is 75%, then the population parameter should be between 65% and 85%, and so in this case 100 randomly selected people should be enough. Of course, pollsters don't just poll until the numbers are right. And using the  $\frac{1}{\sqrt{n}}$  rule of thumb is risky with a population parameter suggested by the 75%.
8.
  - a. Locating every one, getting them to agree to be questioned, not counting anyone twice, training a large number of conscientious interviewers, developing appropriate questions, completing the census in a timely fashion, keeping track of all the data, and so forth.
  - b. Homelessness, finding people, language difficulties, for example.
  - c. Have fewer representatives in Congress, do not get fair share of federal dollars that are distributed according to populations, for example.
  - d. Mobility (people moving during the census, for example, or being at someone else's home when they were being interviewed), claiming more people in a residence than there were, for example. Overcounts could result in the opposite effects as those in part c: Having more representatives in Congress, getting more than the appropriate share of federal dollars, for example.
  - e. Pro: Much less expensive; if done carefully, it might even be more accurate.  
Con: People (especially Congress) might not trust the outcomes; tradition;...
9. Greater than. A larger sample should give a statistic closer to the population parameter.  
$$1/\sqrt{20} = 22\% \quad 40\% \pm 22\% = 18\% \text{ to } 62\%$$
10. With a sample of size 20, the number of browns could vary from, say, ~~8~~ to ~~13~~ (25% to 55%), or even more. With a sample of size 100, the number of browns should vary less, percent-wise, say from 30% to 50%.  
$$40 \pm 10\% = 30\% \text{ to } 50\%$$
11. a. 400 (from  $\frac{1}{\sqrt{n}} = 5\% = \frac{1}{20}$ )      b. 10,000      c. 40,000

### Section 32.2

1. Yes, he could lose, since the confidence interval contains 49%. He could ask that the pollsters take a larger sample to get a smaller confidence interval, but of course then the poll may show him closer to 50%, so the confidence interval could still contain percents below 50. Besides, it would be very expensive to take another poll on the heels of the one he just requested. (Instructor only)
2. The mailings apparently did not give a representative sample, especially with a self-selected 23% returning the sample ballots (23% is not unusual in such a sampling). In 1936, those subscribing to magazines, or owning a car or telephone, may have been a richer part of the population and so gave a biased sample to start with.
3. A 95% confidence interval could be estimated by  $\pm 2$  standard deviations from the sample statistic, so it would be the percent you found earlier,  $\pm 10\%$ . (This can be only an approximation, using your sample proportion as the true population proportion.) You might say, "There is a 95% probability that the percent of time a thumbtack lands point up is in (your interval)."
4. With the margin of error in mind, the percent of the population supporting a change would be in the 51% to 55% interval. If the matter were to be voted on, there is a good chance that there would be some changes to social security. What those changes might be would affect your reaction.
5.
  - a.  $52\% \pm 33\frac{1}{3}\%$ , or  $18\frac{2}{3}\% - 85\frac{1}{3}\%$
  - b.  $52\% \pm 10.5\%$ , or  $41.5\% - 62.5\%$
  - c.  $52\% \pm 3\frac{1}{3}\%$ , or  $48\frac{2}{3}\% - 55\frac{1}{3}\%$
  - d.  $52\% \pm 1\%$ , or  $51\% - 53\%$