第七章

7.4
$$\hat{p}_{sy} = \frac{1}{n}\sum y_i = \frac{132}{200} = .66$$
$$\hat{V}(\hat{p}_{sy}) = \frac{\hat{p}_{sy}\hat{q}_{sy}}{n-1}\left(\frac{N-n}{N}\right) = \frac{(.66)(.34)}{199}\left(\frac{2000-200}{2000}\right)$$
$$B = 2\sqrt{\hat{V}(\hat{p}_{sy})} = .0637$$

7.5
$$N = 2000,\ \hat{p}_{sy} = .66,\ \hat{q}_{sy} = .34,\ D = B^2/4 = (.01)^2/4 = (0.005)^2$$
$$n = \frac{Npq}{(N-1)D + pq} \approx \frac{N\hat{p}_{sy}\hat{q}_{sy}}{(N-1)D + \hat{p}_{sy}\hat{q}_{sy}}$$
$$= \frac{2000(.66)(.34)}{1999(.005)^2 + (.66)(.34)} = 1635.72 \approx 1636$$

Note that the sample size nearly equals the population size, so it is not practical to take the sample. One might better measure every employee or, better yet, agree on a larger margin of error for the survey.

7.6
$$N = 1800 \quad n = 36 \quad \sum y_i = 430.01$$
$$s^2 = .0062$$
$$\hat{\mu} = \bar{y} = 430.01/36 = 11.94$$
$$\hat{V}(\hat{\mu}) = \frac{s^2}{n}\left(\frac{N-n}{N}\right) = \frac{.0062}{36}\left(\frac{1800-36}{36}\right)$$
$$B = 2\sqrt{\hat{V}(\hat{\mu})} = .026$$

7.7
$$N = 1800 \quad s^2 = .0062 \quad D = B^2/4 = .03^2/4$$
$$n = \frac{N\sigma^2}{(N-1)D + \sigma^2} \approx \frac{Ns^2}{(N-1)D + s^2} = 27.02 \approx 28$$

7.9

$$\hat{p}_{sy} = \frac{1}{n}\sum y_i = \frac{324}{400} = .81$$

$$\hat{V}(\hat{p}_{sy}) = \frac{\hat{p}_{sy}\hat{q}_{sy}}{n-1}\left(\frac{N-n}{N}\right) = \frac{.81(.19)}{399}\left(\frac{2800-400}{2800}\right)$$

$$B = 2\sqrt{\hat{V}(\hat{p}_{sy})} = .036$$

7.10

$$n = 45 \quad \sum y_i = 90320 \quad s^2 = 62448.28$$

$$\hat{\mu} = \bar{y} = 90320/45 = 2007.11$$

$$\hat{V}(\hat{\mu}) = \frac{s^2}{n}\left(\frac{N-n}{N}\right) \approx \frac{s^2}{n} = \frac{62448.28}{45}$$

(ignore the fpc, assuming that N is large)

$$B = 2\sqrt{\hat{V}(\hat{\mu})} = 74.505$$

7.11

$$N = 4500 \quad n = 30$$

$$\sum y_i = 850 \quad s^2 = 338.64$$

$$\hat{\tau} = N\bar{y}_{sy} = N\bar{y} = 4500(850/30) = 127500$$

$$\hat{V}(\hat{\tau}) = N^2\frac{s^2}{n}\left(\frac{N-n}{N}\right) = (4500)^2\frac{338.64}{30}\left(\frac{4500-30}{4500}\right)$$

$$B = 2\sqrt{\hat{V}(\hat{\tau})} = 30137.06$$

7.17

$$N = 650 \quad n = 65 \quad \sum y_i = 48$$

$$\hat{p}_{sy} = \frac{1}{n}\sum y_i = \frac{48}{65} = .738$$

$$B = 2\sqrt{\hat{V}(\hat{p}_{sy})} = 2\sqrt{\frac{\hat{p}_{sy}\hat{q}_{sy}}{n-1}\left(\frac{N-n}{N}\right)} = 2\sqrt{\frac{.74(.26)}{64}\left(\frac{650-65}{650}\right)} = .104$$

7.20

$$N = 371 \quad n = 53$$

$$\sum y_i = 11950 \quad s^2 = 705$$

$$\hat{\mu} = \bar{y} = 11950/53 = 225.47$$

$$\hat{V}(\hat{\mu}) = \frac{s^2}{n}\left(\frac{N-n}{N}\right) = \frac{705}{53}\left(\frac{371-53}{371}\right) = 11.40$$

$$B = 2\sqrt{\hat{V}(\hat{\mu})} = \$6.75$$