

## 第七章

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

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

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.

7.6-7.7

7.6  $N = 1800, n = 36, \sum y_i = 430.04$

$$\begin{aligned}
 S^2 &= 0.00581 \\
 \hat{\mu} &= \bar{y} = \frac{430.04}{36} = 11.95 \\
 \hat{V}(\hat{\mu}) &= \frac{S^2}{n} \left( \frac{N-n}{N} \right) = \frac{0.00581}{36} \left( \frac{1800-36}{1800} \right) = 0.00015816111 \\
 B &= 2\sqrt{\hat{V}(\hat{\mu})} = 0.025
 \end{aligned}$$


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7.7  $B = 0.03$

$$\begin{aligned}
 N &= 1800, S^2 = 0.00581, D = \frac{B^2}{4} = \frac{(0.03)^2}{4} = 0.000225 \\
 n &= \frac{N\sigma^2}{(N-1)D + \sigma^2} \approx \frac{Ns^2}{(N-1)D + s^2} = \frac{1800 \times 0.00581}{(1800-1) \cdot (0.000225) + 0.00581} \approx 25.47 \\
 &\approx 26
 \end{aligned}$$

$$\begin{aligned}
 7.9 \quad \hat{p}_{sy} &= \frac{1}{n} \sum y_i = \frac{324}{400} = .81 \\
 \hat{V}(\hat{p}_{sy}) &= \frac{\hat{p}_{sy} \hat{q}_{sy}}{n-1} \left( \frac{N-n}{N} \right) = \frac{.81(.19)}{399} \left( \frac{2800-400}{2800} \right) \\
 B &= 2\sqrt{\hat{V}(\hat{p}_{sy})} = .036
 \end{aligned}$$

7.10

7.10  $n=45$   
 $\sum y_i = 90,320$   
 $S = 250$   
 $\Rightarrow S^2 = 62500$   
 $\hat{\mu} = \bar{y} = \frac{90320}{45} = 2007.11$   
 $\hat{V}(\hat{\mu}) = \frac{S^2}{n} \left( \frac{N-n}{N} \right) \approx \frac{S^2}{n} = \frac{62500}{45} = 1388.888$   
 (當  $N$  非常大時, 可忽略各 f.p.c (有限母體校正因子))  
 $B = 2\sqrt{\hat{V}(\hat{\mu})} = 74.535$  #

$$\begin{aligned}
 7.11 \quad N &= 4500 \quad n = 30 \\
 \sum y_i &= 850 \quad s^2 = 338.64 \\
 \hat{\tau} &= N\bar{y}_{sy} = N\bar{y} = 4500(850/30) = 127500 \\
 \hat{V}(\hat{\tau}) &= N^2 \frac{s^2}{n} \left( \frac{N-n}{N} \right) = (4500)^2 \frac{338.64}{30} \left( \frac{4500-30}{4500} \right) \\
 B &= 2\sqrt{\hat{V}(\hat{\tau})} = 30137.06
 \end{aligned}$$

$$7.17 \quad N = 650 \quad n = 65 \quad \sum y_i = 48$$

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

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

$$7.20 \quad N = 371 \quad n = 53$$

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

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

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

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