E1 review key

Stat 422

(1) 4.20
The Fish and Game Department of a particular state was concerned about the direction of its future hunting programs. To provide for a greater potential for future hunting, the department wanted to determine the proportion of hunters seeking any type of game bird. An SRS of $n = 1000$ of the $N = 99,000$ licensed hunters was obtained. Suppose 430 indicated that they hunted game birds. Estimate p, the proportion of licensed hunters seeking game birds and place a bound on the error of estimation.

(2) 4.21
Using the data from the previous problem, determine the sample size the department must obtain to estimate the porpotion of game bird hunters, given a bound on the error of estimation of 2%. Suppose no proior information is available. What should be used as an estimate of p and what is that sample size?

(3) 4.24
A psychologist wants to estimate the average reaction time to a stimulus among 200 patients in a hospital specializing in nervous disorders. Suppose a new sample is to be chosen in order to estimate μ. With a desired bound on the error of estimation of 1 second and using 1 second as an approximation of the standard deviation, what sample size is required?

(4) 4.27
An investigator is interested in estimating the total number of "count trees" (trees larger than a specified size) on a plantation of $N = 1500$ acres. This information is used to determine the total volume of lumber for trees on the plantation. An SRS of $n = 100$ one-acre plots was selected, and each plot was examined for the number of count trees. The sample average was $\overline{y} = 25.2$ with a sample variance of $s^2 = 136$. Estimate the total number of count trees on the plantation and place a bound on the error of estimation.

(5) 4.28
Using the results from the previous problem, determine the sample size required to estimate τ, the total number of trees on the plantation, with a bound of 1500.

4.20 $$\hat{p} = \frac{1}{n}\sum y_i = \frac{1}{1000}430 = .430$$

$$B = 2\sqrt{\frac{\hat{p}\hat{q}}{n-1}\left(\frac{N-n}{N}\right)} = 2\sqrt{\frac{.430(.570)}{999}\left(\frac{99000-1000}{99000}\right)} = .0312$$

Figure 1:

4.21 $B = .02, \quad D = B^2 \ / \ 4 = (.02)^2 \ / \ 4 \ = .0001$

$$n = \frac{Npq}{(N-1)D + pq}$$

$$= \frac{99000\ (.43)\ (.57)}{98999\ (.0001) + .43\ (57)} = 2391.8 \approx 2392$$

Figure 2:

4.24 $\sigma = 1, \quad B = 1, \quad D = B^2 \ / \ 4 = 1/4 = .25$

$$n = \frac{N\sigma^2}{(N-1)D + \sigma^2} = \frac{200(1)^2}{199\ (.25) + 1^2} = 3.94 \approx 4$$

Figure 3:

4.27 $\hat{\tau} = N\,\bar{y} = 1500(25.2) = 37{,}800$

$$B = 2\sqrt{N^2\left(\frac{s^2}{n}\right)\left(\frac{N-n}{n}\right)} = 2\sqrt{(1500)^2\left(\frac{136}{100}\right)\left(\frac{1500-100}{1500}\right)} = 3379.94$$

Figure 4:

4.28 By using s^2 to estimate σ^2 in Equation (4.14),

$$n = \frac{N\,s^2}{(N-1)D + s^2} = \frac{1500\ (136)}{1499(4) + 136} = 399.4 \approx 400$$

where

$$D = \frac{B^2}{4N^2} = \frac{(1500)^2}{4(1500)^2} = 4$$

Figure 5: