1016-345-01
Probability and Statistics for Engineers

Problem Set 8

Assigned 2011 February 8
Due 2011 February 15

Show your work on all problems! If you use a computer to assist with numerical computations, turn in your source code as well.

1 Devore Chapter 7, Problem 4

2 Devore Chapter 7, Problem 22

3 Devore Chapter 7, Problem 34

4 Devore Chapter 7, Problem 44

5 Computational Exercise (Extra Credit)

a. Assuming a 95% CL (i.e., $\alpha = .05$), and a measured estimate $\hat{p} = .5$ for a population proportion, plot the approximate upper and lower confidence interval limits

$$p_{\pm}(n, \hat{p}) = \frac{\hat{p} + \frac{z^2_{\alpha/2}}{2n} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n} + \frac{z^2_{\alpha/2}}{4n^2}}}{1 + \frac{z^2_{\alpha/2}}{n}}$$

versus n for $n = 2, 4, 6, \ldots, 200$. On the same set of axes, plot the less accurate traditional CI limits $p^{\text{trad}}_{\pm}(n, \hat{p}) = \hat{p} \pm z_{\alpha/2}\sqrt{\hat{p}(1-\hat{p})/n}$.

b. Repeat the process for $\hat{p} = .25$ and $n = 4, 8, 12 \ldots, 200$.

c. Repeat the process for $\hat{p} = .1$ and $n = 10, 20, 30, \ldots, 200$.

d. Extra extra credit: In each case, we can use the exact binomial pmf $b(x; n, p)$ and cdf $B(x; n, p)$ to find the exact probabilities $B(n\hat{p}; n, p_-) - b(n\hat{p}; n, p_-)/2$ and $B(n\hat{p}; n, p_+) - b(n\hat{p}; n, p_+)/2$ that of getting a measurement of $\hat{p}$ or below given a population proportion at the lower or upper end of the CI, respectively. If the approximate formulas for the CI limits were exact, these numbers would be .975 and .025. Plot them versus n and check the validity of this approximation.