ECEN321 : Engineering Statistics
Assignment 8 Submission

Daniel Eisen : 300447549

June 2, 2020

Confidence Intervals

1. (Navidi 5.2.2), $n = 100 \ x = 73$

   (a) $\tilde{p} = \frac{x+2}{n+4} = 0.721153846154$
   $z_{\alpha/2} = 1.96$
   $\tilde{p} \pm z_{\alpha/2} \cdot \sqrt{\frac{\tilde{p}(1-\tilde{p})}{n+4}}$
   $\tilde{p} \pm 0.086185795204 \Rightarrow (0.63496805095, 0.807339641358)$

   (b) $\tilde{p} = \frac{x+2}{n+4} = 0.721153846154$
   $z_{\alpha/2} = 2.575$
   $\tilde{p} \pm z_{\alpha/2} \cdot \sqrt{\frac{\tilde{p}(1-\tilde{p})}{n+4}}$
   $\tilde{p} \pm 0.113228787066 \Rightarrow (0.607925059087, 0.83438263322)$

   (c) $n = \left(\frac{1.96\sqrt{\tilde{p}(1-\tilde{p})}}{0.05}\right)^2 - 4 \approx 305$
   note as $\tilde{p}$ is relative to previous n, the actual required n is lower, but 305 will still bring the E below 0.05.

   (d) $n = \left(\frac{2.575\sqrt{\tilde{p}(1-\tilde{p})}}{0.05}\right)^2 - 4 \approx 530$
   note as $\tilde{p}$ is relative to previous n, the actual required n is lower, but 530 will still bring the E below 0.05.

   (e) $p = 0.7, n = 100, \tilde{p} = 0.72115$
   $z = \frac{p-\tilde{p}}{\sqrt{\frac{\tilde{p}(1-\tilde{p})}{n+4}}} = -0.48$
   $P(Z > -0.48) = .6844 = 68.44\%$

   (f) $n = 200, p = 0.95, k = 193...200$
   $P(X = k) = \frac{n!}{k!(n-k)!} \cdot p^k \cdot (1-p)^{n-k}$
   $P(X > 192) = \sum_{k=193}^{200} \frac{n!}{k! \cdot (n-k)!} \cdot p^k \cdot (1-p)^{n-k} = 0.2133$
   I used wolfram to compute the sum, due to the large factorial.

2. (Navidi 5.3.8) $\bar{X} = 3410.14$, $s = 1.018$, $n = 8$, $df \ = 7$, $CI = \bar{X} \pm t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$

   (a) $t_{\alpha/2} = 2.356$
   $CI = 3410.14 \pm 2.356 \cdot \frac{1.018}{\sqrt{8}} \Rightarrow (3409.29, 3410.99)$

   (b) $t_{\alpha/2} = 2.998$
   $CI = 3410.14 \pm 2.998 \cdot \frac{1.018}{\sqrt{8}} \Rightarrow (3409.06, 3411.22)$

   (c) No, because to able to use the student t CI's and calculations the samples must come from a population that is approximately normal, as seen by the outlier (3412.66) this sample cannot be said to come from a normal population so the above CI's cannot be used.

3. (Navidi 5.6.13)

$$X = (207.4,\ 233.1,\ 215.9,\ 235.1,\ 225.6,\ 244.4,\ 245.3)$$
$$\bar{X} = 229.54,\ s_X = 14.17,\ n_X = 7$$

$$Y = (84.3,\ 53.2,\ 127.3,\ 201.3,\ 174.2,\ 246.2,\ 149.4,\ 156.4,\ 103.3)$$
$$\bar{Y} = 143.96,\ s_Y = 59.76,\ n_Y = 9$$

$$CI = \bar{X} - \bar{Y} \pm z_{\alpha/2} \cdot \sqrt{\frac{s_X^2}{n_X} + \frac{s_Y^2}{n_Y}}, \quad z_{\alpha/2} = 1.96$$
$$85.58 \pm 1.96 \cdot \sqrt{\frac{14.17^2}{7} + \frac{59.76^2}{9}} \approx 85.58 \pm 40.43$$
$$CI = (45.15,\ 126.01)$$