Statistics & Inferencing Homework #03

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Chapter 8 → Ken Black

P8.3) $n = 81$ $\bar{x} = 47$ $\sigma = 5.89$ CI = 90%
$\alpha = 0.1$ $\alpha/2 = 0.05$ $z_{\alpha/2} = 1.645$
$\bar{x} - z_{\alpha/2}\,\sigma/\sqrt{n} \le \mu \le \bar{x} + z_{\alpha/2}\,\sigma/\sqrt{n}$
$47 - 1.645\left[\frac{5.89}{\sqrt{81}}\right] \le \mu \le 47 + 1.645\left[5.89/\sqrt{81}\right]$
$45.923 \le \mu \le 48.077$

P8.9) $n = 36$ $\sigma = 1.17$ CI = 98% $\alpha = 0.02$ $\alpha/2 = 0.01$
$z_{\alpha/2} = 2.3263$ $\bar{x} = \Sigma x_i / n = 3.3056$
$3.3056 - 2.3263(1.17/\sqrt{36}) \le \mu \le 3.3056 + 2.3263(1.17/\sqrt{36})$
$2.852 \le \mu \le 3.759$

P8.13) CI = 95% $n = 13$ $\bar{x} = 45.615$ ← $\Sigma x = 593$
$\Sigma x^2 = 27439$ $s_{\bar{x}} = 5.47$
$\alpha = 0.05$ $\alpha/2 = 0.025$
$t(\alpha/2, n-1) = 2.1788$
$45.615 - 2.1788\left[5.47/\sqrt{13}\right] \le \mu \le 45.615 + 2.1788\left[5.47/\sqrt{13}\right]$
$42.31 \le \mu \le 49.0$

P8.17) CI = 99% $n = 25$ $\Sigma x = 402.2$ $\Sigma x^2 = 6486.6$
$\bar{x} = 16.088$ $\sigma_{\bar{x}} = 0.800$ Point Estimate = 16.088
$\alpha = 0.01$ $\alpha/2 = 0.005$
$t(\alpha/2, n-1) = 2.7969$
$16.088 - 2.7969(0.8/\sqrt{25}) \le \mu \le 16.088 + 2.7969(0.8/\sqrt{25})$
$15.6 \le \mu \le 16.54$

P8.25) (a) $n = 44$ $\hat{p} = 0.51$ CI = 90% $\alpha = 0.1$ $z_{\alpha/2} = 1.645$
$0.51 - 1.645\sqrt{(0.51)(0.49)/44} \le p \le 0.51 + 1.645\sqrt{(0.51)(0.49)/44}$
$0.386 \le p \le 0.634$

(b) $n = 300$ $\hat{p} = 0.82$ CI = 90% $\alpha = 0.05$ $z_{\alpha/2} = 1.96$
$\hat{p} - z_{\alpha/2}\sqrt{\hat{p}\hat{q}/n} \le p \le \hat{p} + z_{\alpha/2}\sqrt{\hat{p}\hat{q}/n}$
$0.777 \le p \le 0.863$

(c) $n = 1150$ $\hat{p} = 0.48$ CI = 90% $0.456 \le p \le 0.504$

(d) $n = 95$ $\hat{p} = 0.32$ CI = 88% $0.246 \le p \le 0.394$

P8.27) $n = 84$ 40 items contain characteristic of interest

① CI = 90% ② CI = 95% ③ CI = 99%

$\alpha = 0.1$ $z_{\alpha/2} = 1.645$ $z_{\alpha/2} = 1.96$ $z_{\alpha/2} = 2.5758$

$\hat{p} = 40/84 = 0.48$ $\hat{q} = 0.52$

$\hat{p} \pm z_{\alpha/2}\sqrt{\hat{p}\cdot\hat{q}/n}$

① CI = 90%: $0.386 \le p \le 0.566$

② CI = 95%: $0.369 \le p \le 0.573$

③ CI = 99%: $0.336 \le p \le 0.616$

As the level of confidence increases, the confidence interval increases as the value of p deviates, move from the true value - margin of error increases.

P8.35) (a) $n = 12$ $\bar{x} = 28.4$ $s^2 = 44.9$ CI = 99%

$(n-1)s^2/\chi^2_{\alpha/2} \le \sigma^2 \le (n-1)s^2/\chi^2_{1-\alpha/2}$ $\alpha = 0.01$ $\alpha/2 = 0.005$

$\chi^2_{\alpha/2,11} = 26.7568$ $\chi^2_{1-\alpha/2,11} = 2.6032$

$11 \times 44.9/26.7568 \le \sigma^2 \le 11 \times 44.9/2.6032$

$18.46 \le \sigma^2 \le 189.73$

(b) $n = 7$, $\bar{x} = 4.37$ $s = 1.24$ CI = 95% $\alpha = 0.05$

$s^2 = 1.5376$ $\chi^2_{\alpha/2,6} = 14.4494$ $\chi^2_{1-\alpha/2,6} = 1.2376$ $\alpha/2 = 0.025$

$0.064 \le \sigma^2 \le 7.46$

(c) $n = 20$, $\bar{x} = 105$, $s = 32$, 90% CI $\alpha/2 = 0.05$ $s^2 = 1024$

$645.45 \le \sigma^2 \le 1923.10$

(d) $n = 17$, $s^2 = 18.56$, 80% CI $12.61 \le \sigma^2 \le 31.89$

P8.37) $n = 20$ $sd = 4.3$ 98% CI $\alpha/2 = 0.01$

$\chi^2_{\alpha/2,19} = 36.1909$ $\chi^2_{1-\alpha/2,19} = 7.6327$

$s^2 = (4.3)^2$

$(19)(4.3)^2/36.1909 \le \sigma^2 \le (19)(4.3)^2/7.6327$

$9.707 \le \sigma^2 \le 46.03$

Point Estimate = $s^2 = 4.3^2 = 18.49$