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§8.9 CHOOSING THE SAMPLE SIZE

70. $z_{\alpha/2}(\text{S.E.}) \le 1.6$, $\text{S.E.} = \dfrac{\sigma}{\sqrt{n}}$

$$1.96\left(\frac{12.7}{\sqrt{n}}\right) \le 1.6 \rightarrow \frac{(1.96)(12.7)}{1.6} \le \sqrt{n}$$

$$n \ge \left(\frac{(1.96)(12.7)}{1.6}\right)^2 \approx 242.04 \xrightarrow[\text{UP}]{\text{ROUND}} \boxed{243}$$

71. $z_{\alpha/2}(\text{S.E.}) \le .04$, $\text{S.E.} = \sqrt{\dfrac{pq}{n}}$

BIGGER WHEN p CLOSER TO $.5$

SO CHOOSE $p = .3$

$$1.96\sqrt{\frac{(.3)(.7)}{n}} \le .04 \longrightarrow \frac{(.3)(.7)}{n} \le \left(\frac{.04}{1.96}\right)^2$$

$$n \ge \frac{(.3)(.7)}{\left(\frac{.04}{1.96}\right)^2} \approx 504.21 \xrightarrow{\text{ROUND UP}} \boxed{505}$$

72. $z_{\alpha/2}(\text{S.E.}) \le .17$, $\text{S.E.} = \sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$, $n_1 = n_2 = n$

$$1.645\sqrt{\frac{27.8^2}{n} + \frac{27.8^2}{n}} \le .17 \longrightarrow \sqrt{\frac{2(27.8)^2}{n}} \le \frac{.17}{1.645}$$

$$n \ge \frac{2(27.8)^2}{\left(\frac{.17}{1.645}\right)^2} \approx 1447.3 \longrightarrow \boxed{1448}$$

73. $z_{\alpha/2}\,(S.E.) \le .05$, $S.E = \sqrt{\dfrac{p_1q_1}{n_1} + \dfrac{p_2q_2}{n_2}}$. $n_1 = n_2 = n$

ASSUME $p_1 = p_2 = .5$ — THIS MAXIMIZES S.E.

$$2.33\sqrt{\frac{(.5)(.5)}{n} + \frac{(.5)(.5)}{n}} \le .05$$

$$\sqrt{\frac{.5}{n}} \le \frac{.05}{2.33} \longrightarrow n \ge \frac{.5}{\left(\frac{.05}{2.33}\right)^2} \approx 1085.8 \longrightarrow \boxed{1086}$$

75. (a) SAMPLE MUST BE RANDOM. THIS IS HARD TO DO.
YOU COULD DIAL RANDOM TELEPHONE NUMBERS, BUT NOT EVERYONE HAS A PHONE, AND SOME PEOPLE DON'T ANSWER CALLS FROM UNKNOWN NUMBERS.
OTHER IDEAS?

(b) $z_{\alpha/2}\,(S.E.) \le .01$ $S.E. = \sqrt{\dfrac{pq}{n}}$ ASSUME $p = .5$

$$1.96\sqrt{\frac{(.5)(.5)}{n}} \le .01 \longrightarrow \frac{(.25)}{n} \le \left(\frac{.01}{1.96}\right)^2$$

$$n \ge \frac{(.25)}{\left(\frac{.01}{1.96}\right)^2} = \boxed{9604}$$

76. $z_{\alpha/2}\,(S.E.) \le .03$, $S.E. = \sqrt{\dfrac{p_1q_1}{n_1} + \dfrac{p_2q_2}{n_2}}$ $n_1 = n_2 = n$

ASSUME $p_1 = p_2 = .5$

$$\underset{\text{MY CHOICE}}{1.96}\sqrt{\frac{.5}{n}} \le .03 \rightarrow n \ge \frac{.5}{\left(\frac{.03}{1.96}\right)^2} \approx 2134.2$$

$$\rightarrow \boxed{2135}$$

77. $z_{\alpha/2}(S.E.) \le 5$ $\qquad S.E. = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$

$n_1 = n_2 = n$, ASSUME $s_1 = s_2 = \frac{\text{RANGE}}{4} = \frac{104 - 0}{4} = 26$

$$2.58\sqrt{\frac{2(26)^2}{n}} \le 5 \rightarrow n \ge \frac{2(26)^2}{\left(\frac{5}{2.58}\right)^2} \approx 359.98 \rightarrow \boxed{360}$$

79. $z_{\alpha/2}(S.E.) \le 2$ $\qquad S.E. = \frac{\sigma}{\sqrt{n}}$

$$1.96\left(\frac{10}{\sqrt{n}}\right) \le 2 \rightarrow n \ge \left(\frac{10}{\left(\frac{2}{1.96}\right)}\right)^2 = 96.04 \rightarrow \boxed{97}$$

↑ THIS IS MY DEFAULT

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80. $z_{\alpha/2}(S.E.) \le .1$ $\qquad S.E. = \frac{\sigma}{\sqrt{n}}$

$$1.96\left(\frac{.5}{\sqrt{n}}\right) \le .1 \rightarrow n \ge \left(\frac{.5}{\left(\frac{.1}{1.96}\right)}\right)^2 \approx 96.04 \rightarrow \boxed{97}$$

NOT APPROPRIATE TO GATHER ALL SAMPLES FROM A SINGLE RAINFALL. THE AMOUNT OF POLLUTION GIVEN OFF BY POWER PLANT MAY VARY, AND DIRECTION OF WIND MAY AFFECT WHERE THE POLLUTION GOES.

81. $z_{\alpha/2}\,(S.E.) \leq .1 \qquad S.E. = \sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$

ASSUME $\sigma_1^2 = \sigma_2^2 = .25$, $n_1 = n_2 = n$

$$1.645\sqrt{\frac{.5}{n}} \leq .1 \longrightarrow n \geq \frac{.5}{\left(\frac{.1}{1.645}\right)^5} \approx 135.3 \longrightarrow \boxed{136}$$

82. $z_{\alpha/2}\,(S.E.) \leq .2 \qquad S.E. = \sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$

ASSUME $\sigma_1^2 = \sigma_2^2 = (.6)^2$ AND $n_1 = n_2 = n$

$$1.96\sqrt{\frac{2(.6)^2}{n}} \leq .2 \longrightarrow \frac{2(.6)^2}{\left(\frac{.2}{1.96}\right)^2} \approx 69.1 \longrightarrow \boxed{70}$$

83. $z_{\alpha/2}\,(S.E.) \leq 5 \qquad S.E. = \sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}$

$\sigma_1^2 \approx s_1^2 = (24.3)^2 \qquad \sigma_2^2 \approx s_2^2 = (17.6)^2$

ASSUME $n_1 = n_2 = n$

$$1.645\sqrt{\frac{(24.3)^2 + (17.6)^2}{n}} \leq 5 \longrightarrow n \geq \frac{(24.3)^2 + (17.6)^2}{\left(\frac{5}{1.645}\right)^2} \approx 97.4$$

$$n \geq \boxed{98}$$