Statistics Unit 7 worksheet: One sample interval for a proportion and sample size

Name _____ Date _____ Period _____

1. Housing inspectors in a city of about 64,000 rental apartments visit a simple random sample of 400 apartments and find that 296 have a working smoke alarm (made-up data). Use $z^* = 1.96$ for 95% confidence.

Carry out a 95% confidence interval for the share of all the city's rental apartments with a working smoke alarm, in four steps: (a) Parameter, (b) Conditions, with the numbers, (c) Compute (standard error and margin of error to four decimal places, the ends to three decimal places, from unrounded values), (d) Conclude in context.

2. Find the smallest sample size that gives a margin of error no larger than m at the stated level, using the planning guess p^* given ("none" means no prior estimate). Use $z^* = 1.645$, 1.96 and 2.576 for 90%, 95% and 99% confidence. Show the bound to two decimal places before you round.

(a) $95\%,\ m = 0.04,$ none

(b) $90\%,\ m = 0.035,\ p^* = 0.30$

(c) $99\%,\ m = 0.05,$ none

(d) $95\%,\ m = 0.02,\ p^* = 0.12$

3. Marine biologists capture a random sample of 360 adult horseshoe crabs from a large bay, whose adult population is in the hundreds of thousands, and find that 126 are female (made-up data). Use $z^* = 1.645$ for 90% confidence.

(a) Carry out a 90% confidence interval for the share of the bay's adult horseshoe crabs that are female: Parameter, Conditions with the numbers, Compute (four decimal places for SE and ME, three for the ends), Conclude in context.

(b) A survey from many years ago reported that 40% of the bay's adult crabs were female. A fishery council now says the share is about one third. For each value, say whether the interval makes it plausible, and what that does and does not show.

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4. A cruise line carried about 250,000 passengers last year. It plans one random sample of passengers that will answer three yes-or-no questions, and it wants a 95% interval with a margin of error of at most 0.035 for each question. Last year's smaller survey gave these estimates (made-up data): first cruise ever, 0.58; travelled with children, 0.18; booked a shore excursion, 0.35. Use $z^* = 1.96$.

(a) Find the sample size each question needs on its own, using last year's estimate as the planning guess.

(b) What sample size should the line use for the whole survey, and why is it the question whose guess is nearest 0.5 that decides?

(c) How many passengers would the safe guess $p^* = 0.5$ require, and what would the extra passengers buy?

5. A state has about 12,000 small farms. A simple random sample of 450 finds 171 that sell part of their crop directly to consumers (made-up data). A student hands in this 95% interval.

Parameter: $p = 0.38$, the proportion of the 450 farms that sell directly.

Conditions: Random, yes. 10%: 450 is less than 1,200. Large Counts: 171 ≥ 10.

Compute: SE $= \sqrt{0.38 \times 0.62/450} \approx 0.0229$, and with $z^* = 1.645$ the interval is 0.38 ± 0.0376, from 0.342 to 0.418.

Conclude: There is a 95% probability that between 34.2% and 41.8% of the 450 farms sell directly.

(a) Find the mistake in each of the four steps and say why it is a mistake.

(b) Write each step correctly (use $z^* = 1.96$; four decimal places for the margin, three for the ends).

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