Ch 18 Confidence Intervals for Proportions Reference Sheet

Confidence Interval: A level C *(usually 90, 95, or 99%)* confidence interval for a model parameter is a range of values usually of the form --- *estimate ± margin of error* **(p ± ME)** --- to show C% of all random sample will yield intervals that capture the true parameter value (p).

Check for Assumptions and Conditions for finding and interpreting confidence intervals

1) Independence Assumption: sampled values are independent from each other.
2) Randomization Condition: must be random sample
3) 10% Condition: When not independent, the sample should be no more than 10% of the population
4) Success/Failure Condition: expect at least 10 successes and failures

Purpose: to draw conclusions and analyze outcomes by predicting the range of values most random samples will fall within.

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p= parameter of success
q= parameter of failure
n = sample size
z = critical value (z score) corresponding to confidence level

Critical Value (z*)*:* the number of standard errors (estimated deviations) to move away from the sample statistic (p) to specify the interval for a specified confidence level.

Components of Confidence Intervals (also known as One-Proportion z-Interval)

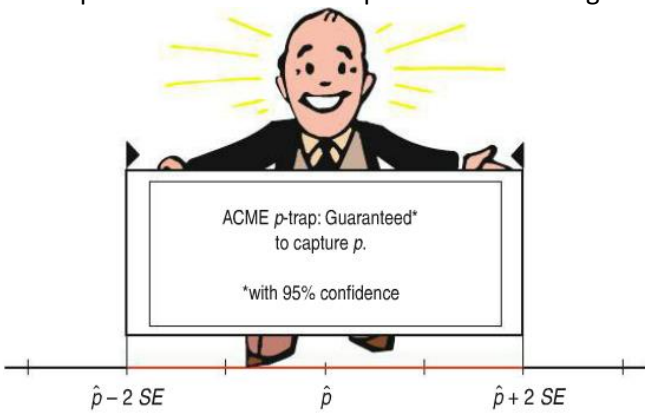
Component	Description	Formula
Standard Error (SE) (same as SD)	Estimate of the standard deviation (spread)	$SE(\hat{p}) = \sqrt{\frac{\hat{p}\hat{q}}{n}}$
Margin of Error (ME)	Extent of the interval on either side of the p value. *Product of critical value and standard error (SD estimate)*	$ME = z^* \sqrt{\frac{\hat{p}\hat{q}}{n}}$
One-Proportion z-interval	Confidence interval	$\hat{p} \pm z^* SE(\hat{p})$
Calculator: 1-PropZint *STAT>TESTS>1-PropZint* x = # of successes n = sample size C-level = confidence level (%)	Calculates confidence intervals	

Tips:

- Error doesn't mean mistake; it means how much variability from the true value p.
- Write a confidence interval as a range in decimals (low end, high end)
- A confidence interval is always concluded with a formal statement with percentages for the range
- Work backwards for the sample size if given the ME
- ME of 5% or less is acceptable
- Confidence intervals want to "trap" the true value within the range
- Confidence intervals work with Normal Models and the 68-95-99.7 Rule

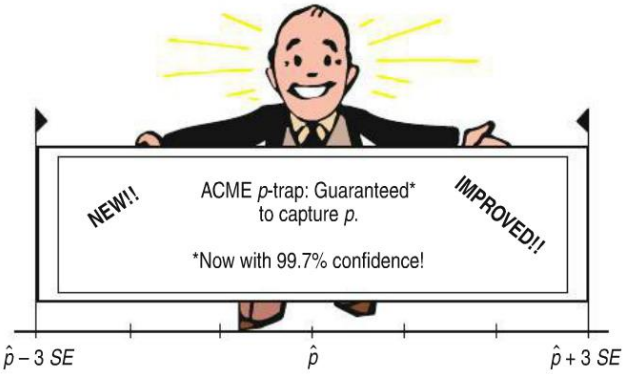
Confidence Interval for 95% (2 standard deviations, or 2SE)

"traps" 95% of random samples within the range



Confidence Interval for 99.7% (3 standard deviations, or 3SE)

"traps" 99.7% of random samples within the range



Example of multiple confidence intervals

Green Line = true value (p)

Each segment represents a confidence interval with an attempt to "trap" the true value, p, within its range.

Not all are successful, which is why we cannot assume 100% confidence