

8.8: Formula Review

A Confidence Interval for a Population Standard Deviation Unknown, Small Sample Case

s = the standard deviation of sample values.

$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$ is the formula for the t-score which measures how far away a measure is from the population mean in the Student's t-distribution

$df = n - 1$; the degrees of freedom for a Student's t-distribution where n represents the size of the sample

$T \sim t_{df}$ the random variable, T , has a Student's t-distribution with df degrees of freedom

The general form for a confidence interval for a single mean, population standard deviation unknown, and sample size less than 30

Student's t is given by: $\bar{x} - t_{v,\alpha} \left(\frac{s}{\sqrt{n}} \right) \leq \mu \leq \bar{x} + t_{v,\alpha} \left(\frac{s}{\sqrt{n}} \right)$

A Confidence Interval for A Population Proportion

$p' = \frac{x}{n}$ where x represents the number of successes in a sample and n represents the sample size. The variable p' is the sample proportion and serves as the point estimate for the true population proportion.

$$q' = 1 - p' \quad (8.8.1)$$

The variable p' has a binomial distribution that can be approximated with the normal distribution shown here. The confidence interval for the true population proportion is given by the formula:

$$p' - Z_{\alpha} \sqrt{\frac{p'q'}{n}} \leq p \leq p' + Z_{\alpha} \sqrt{\frac{p'q'}{n}} \quad (8.8.2)$$

$n = \frac{Z_{\alpha}^2 p'q'}{e^2}$ provides the number of observations needed to sample to estimate the population proportion, p , with confidence $1 - \alpha$ and margin of error e . Where e = the acceptable difference between the actual population proportion and the sample proportion.

Calculating the Sample Size n : Continuous and Binary Random Variables

$n = \frac{Z_{\alpha}^2 \sigma^2}{(\bar{x} - \mu)^2}$ = the formula used to determine the sample size (n) needed to achieve a desired margin of error at a given level of confidence for a continuous random variable

$n = \frac{Z_{\alpha}^2 pq}{e^2}$ = the formula used to determine the sample size if the random variable is binary

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