8.8: Chapter Formula Review

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

s = the standard deviation of sample values.

$t = \frac{\overline{x}-\mu}{\frac{s}{\sqrt{n}}}$ 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: $\overline{x} - t_{\mathrm{v},\alpha}\left(\frac{s}{\sqrt{n}}\right) \leq \mu \leq \overline{x} + t_{\mathrm{v},\alpha}\left(\frac{s}{\sqrt{n}}\right)$

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.

$$q' = 1 - p' \tag{8.8.1}$$

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:

$$\mathrm{p}' - Z_\alpha \sqrt{\frac{\mathrm{p}'\mathrm{q}'}{n}} \leq p \leq \mathrm{p}' + Z_\alpha \sqrt{\frac{\mathrm{p}'\mathrm{q}'}{n}} \tag{8.8.2}$$

$n = \frac{Z_{\frac{\alpha}{2}}^2 p'q'}{e^2}$ 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

$n = \frac{Z^2\sigma^2}{(\overline{x}-\mu)^2}$ = 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

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