Population Confidence Interval Theory

Overall Theory to Know Moving Forward

- A numerical measure of a population is known as ___population parameter___
  - This is based on ALL values of the population
- A numerical descriptive measure of a sample is known as ___sample statistic___
  - Found in calculations using observations from experiments
- The probability distribution of the statistics constructed from many samples of the same size is known as the ___sampling distribution___

	Population Parameter	Sample Statistic
Mean	μ	$\bar{x}$
Median	η	M or Q_2
Variance	σ^2	s^2
Standard Deviation	σ	s
Binomial Proportion	p	$\hat{p}$

Confidence Interval Theory to Know

- A number that is calculated from a sample to estimate the target parameter is known as the ___Point Estimate___
- The interval of numbers calculated from a sample that contains the target parameter is known as the ___Confidence Interval___
- The probability that the estimation method will generate a ___Confidence Interval___ is known as the ___Confidence Level___
  - The most common values used are: 99%, 95%, 90%
- The complement of the ___Confidence Level___ is known as the ___Type I Error or α___
  - To find this, we use: $\alpha = 1 - (\text{confidence level})$
  - The most common values used are: 1%, 5%, 10%
- The overall formula for finding Confidence Interval is...

(Point Estimate ± Margin of Error)

(PE − MOE, PE + MOE)

- The way we solve for the confidence interval depends on the sample size.
  - Considered large if both conditions are met and small if 1 or both conditions are not met.

$$n\hat{p} \geq 10 \qquad n\hat{q} \geq 10$$

- Formulas to understand:
  - Critical Value or $z_{\alpha/2}$

$$z_{\alpha/2} = |\text{invNorm}(\tfrac{\alpha}{2}, \mu, \sigma)|$$

  - Margin of Error (MOE)
    - For large sample

$$MOE = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

    - For small samples

$$MOE = z_{\alpha/2}\sqrt{\frac{\tilde{p}\tilde{q}}{n+4}}$$

  - Point Estimate (PE)
    - For large samples

$$PE = \hat{p} = \frac{x}{n}$$

    - For small samples

$$PE = \tilde{p} = \frac{x+2}{n+4}$$

- Interpretation Set-up:

We are % confident that the true unknown population parameter lies in the interval (solved conf. dence interval).