Important Point Estimators

(We will use these more in Ch 7)

Assuming $X_1, X_2, \ldots, X_n$ are IID samples with

Population Mean $E[X] = \mu$

Population Variance $Var[X] = \sigma^2$

Sample Mean $\bar{X}$

$$E[\bar{X}] = \mu$$

$$Var[\bar{X}] = \sigma^2/n$$

$$\hookrightarrow \sigma_{\bar{X}} = \sigma/\sqrt{n}$$

Sample Variance S^2

$$E[S^2] = \sigma^2$$

$$Var[S^2] = \cdots \text{ (complicated)}$$

Formulas:

$$\bar{X} = \frac{X_1 + X_2 + \cdots + X_n}{n} = 1/n\,[X_1 + \cdots + X_n] = \boxed{\frac{1}{n} T_0}$$

$$S^2 = \frac{(X_1 - \bar{X})^2 + \cdots + (X_n - \bar{X})^2}{n-1}$$

$$= \frac{1}{n-1}\left[(X_1^2 + \cdots + X_n^2) - \frac{1}{n}(X_1 + \cdots + X_n)^2\right] = \boxed{\frac{1}{n-1}\left[T_1 - \frac{1}{n}T_0^2\right]}$$

Sample Proportion $\hat{p}$

Assuming $X \sim \text{Binomial}(n, p)$

Population Proportion p

Population Size n

Recall: $q = (1-p)$ "Complementary Proportion"

$$E[\hat{p}] = p$$

$$Var[\hat{p}] = pq/n$$

$$\hookrightarrow \sigma_{\hat{p}} = \sqrt{pq/n}$$