Econometrics  ch. 16.

Mean of a sample \( \bar{X} = \frac{\sum X_i}{n} \)

\( X_i \): observation \( i \)
\( n \): sample size

Variance \( = \frac{\sum (X_i - \bar{X})^2}{n-1} = s^2 \)

Standard deviation \( s = \sqrt{\text{Variance}} \)

\( \bar{X} \): computed mean
\( \mu \): mean in null hypothesis

\( Z \)-statistics: \( \frac{\bar{X} - \mu}{s/\sqrt{n}} \)

Confidence intervals

\( \bar{X} \pm z^* \) (standard error)

Hypothesis test

Compare \( Z \)-stats w/ critical \( Z \) (\( Z^* \))

\( \bar{X} - Z^*(\text{std. error}) < \mu < \bar{X} + Z^*(\text{std. error}) \)

\( \bar{X} \pm Z^*(\text{std. error}) \)

\( z \)-critical given degrees of freedom \( n-1 \)

P-values: probability Ho is true

Lowest level of significance at which Ho can be rejected

(high \( Z \)-value → low p-value)

\( p = 0.03 \)

3\% probability Ho is true

Ho can be rejected at 5\%. It cannot be rejected at 1\%.
\[ \bar{X} = 5 \]
\[ \text{std. error} = 1 \]
\[ N = 25 \]
\[ t = 25 - 1 = 2.4 \]

1. **Construct 95\% C.I.**
   \[ t^* \text{ two sided } 5\% = 2.064 \]
   \[ 5 \pm 2.064 \times 1 \]
   \[ \left[ \begin{array}{c} 2.936 \\ 7.064 \end{array} \right] \]
   95\% population mean within this range.

2. **Hypothesis testing:**
   \[ t^* \text{ two sided } 5\% = 2.064 \]
   \[ H_0: \mu = 2.5 \]
   \[ H_1: \mu \neq 2.5 \]

   \[ \frac{5 - 2.5}{1} = 2.5 > t^* \]
   \[ \text{Reject} \]

   \[ \frac{5 - 3}{1} = 2 < 2.064 \]
   \[ \text{Not Reject} \]

   (95\% sure pop. mean between 2.936 \& 7.064)

   Since 3 is within the interval, not surprising we do not reject \( H_0: \mu = 3 \).