Confidence Interval Population Mean

Find the following information from the problem:

$\bar{x}$, s, n, Confidence level or α

What is the Point Estimate?

$PE = \bar{x} = \frac{\Sigma x}{n}$

Is the sample large enough?

$n < 30$ or $n \geq 30$

Not large enough:

- Uses T-distribution
- Margin of Error

$MOE = \underbrace{t_{\alpha/2}}\frac{s}{\sqrt{n}}$

$t_{\alpha/2} = \left|\text{invT}\left(\frac{\alpha}{2}, df\right)\right|$

Large enough:

- Uses Z-distribution
- Margin of Error

$MOE = \underbrace{z_{\alpha/2}}\frac{s}{\sqrt{n}}$

$z_{\alpha/2} = \left|\text{invNorm}\left(\frac{\alpha}{2}, 0, 1\right)\right|$

Construct the Confidence Interval

$(PE - MOE,\ PE + MOE)$

Interpret the Confidence Interval

We are [confidence level]% that the true unknown population mean lies in the interval [confidence interval].

Via Calculator

Not large enough

- Uses TInterval

(Stat → Tests → TInterval)

- When given data, need:
  - List (input in calc.)
  - Confidence level
- When given stats, need:
  - $\bar{x}$ — S — n
  - Confidence level

Large enough

- Uses ZInterval

(Stat → Tests → ZInterval)

- When given data, need:
  - List (in calc) — s
  - Confidence level
- When given stats, need:
  - $\bar{x}$ — s — n
  - Confidence level

Confidence Interval Population Proportion

Find the following information from the problem:

$\bar{x}$, s, n, $\hat{p}$, $\hat{q}$, Confidence level or α

Is the sample large enough?

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

Not large enough:

- Wilson's Adjustment
- Point Estimate

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

- Margin of Error

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

$z_{\alpha/2} = \left|invNorm\left(\frac{\alpha}{2}, 0, 1\right)\right|$

Large enough:

- Point Estimate

$PE = \hat{p} = \frac{\#\text{ of success}}{\text{total}}$

- Margin of Error

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

$z_{\alpha/2} = \left|invNorm\left(\frac{\alpha}{2}, 0, 1\right)\right|$

Construct the Confidence Interval

$(PE - MOE, PE + MOE)$

Interpret the Confidence Interval

We are [confidence level]% confident that the true unknown population proportion lies in the interval [confidence interval].

Via Calculator

- Uses 1-PropZInt

(Stat → Tests → 1-PropZInt)

- You will need:
  - x
  - n
  - Confidence level

One Sample Population Mean

Find the following information from the problem:

$\bar{x}$, s, n, α, H_0, H_1, μ_0

State the Hypothesis.

$H_0: \mu = \mu_0$ (already known/old)

$H_1: \mu\ (>\ \neq\ <)\ \mu_0$ (already known/old)

What direction does H_1 express?

Finding the Test Statistic.

$$TS = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

Finding the p-value.

Left-sided ($\mu < \mu_0$)

$p = tcdf(-E99, TS, df)$

Two-sided ($\mu \neq \mu_0$)

$-TS: p = 2 \times tcdf(-E99, TS, df)$

$+TS: p = 2 \times tcdf(TS, E99, df)$

Right-sided ($\mu > \mu_0$)

$p = tcdf(TS, E99, df)$

Making a decision and its' interpretation

Rejecting Null

$\alpha > p$

- Think packman (>) want α so it rejects p

At [α]% level of significance, we have sufficient evidence to say that [H_1 scenario].

Failing to Reject Null

$\alpha < p$

- Think packman wants p so its failing to reject p

At [α]% level of significance, we do not have sufficient evidence to say that [H_1 scenario].

Via Calculator

• Uses T-Test

Given Data, you need:	Given Stats, you need:	
$-\mu_0$	$-\mu_0$	$-n$
-List (inputted in calc)	$-\bar{x}$	$-H_1$
$-H_1$	$-s$	

One Sample Population Proportion

Find the following information from the problem:

$\hat{p}$, p_0, q_0 n, H_0, H_1, α

State the Hypothesis.

$H_0: p = p_0$ (already known/old)

$\underbrace{H_1: p\,(> \neq <)\, p_0 \text{ (already known/old)}}_{\text{What direction does } H_1 \text{ express?}}$

Finding the Test Statistic.

$$TS = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}}$$

Finding the p-value.

Left-sided ($p < p_0$)

p = normalcdf(-E99, TS, 0, 1)

Two-sided ($p \neq p_0$)

-TS: p = 2 × normalcdf(-E99, TS, 0, 1)

+TS: p = 2 × normalcdf(TS, E99, 0, 1)

Right-sided ($p > p_0$)

p = normalcdf(TS, E99, 0, 1)

Making a decision and its' interpretation

Rejecting Null

$\alpha > p$

- Think packman (>) wants α so it rejects p

At [α]% level of significance, we have sufficient evidence to say that [H_1 scenario].

Failing to Reject Null

$\alpha < p$

- Think packman (<) wants p so it fails to reject p

At [α]% level of significance, we do not have sufficient evidence to say that [H_1 scenario].

Via Calculator

- Uses 1-PropZTest

(Stat → Tests → 1-PropZTest)

- You will need:
  - p_0
  - x
  - n
  - H_1

Two Sample Paired Testing

Find the following information from the problem: n, H_0, H_1, α

Diff. Col., $\bar{d}$, S_d

State the Hypothesis.

$H_0: \mu_d = d_0$ or $\mu_d = 0$

$H_1: \mu_d (> \neq <) d_0$ or 0

What direction does H_1 express?

Finding the Test Statistic.

$$TS = \frac{\bar{d} - d_0}{S_d / \sqrt{n}}$$

Finding the p-value.

Left-sided ($\mu_d < 0$)

$p = tcdf(-E99, TS, df)$

Two-sided ($\mu_d \neq 0$)

$-TS$: $p = 2 \times tcdf(-E99, TS, df)$

$+TS$: $p = 2 \times tcdf(TS, E99, df)$

Right-sided ($\mu_d > 0$)

$p = tcdf(TS, E99, df)$

Making a decision and its' interpretation

Rejecting Null

$\alpha > p$

-Think packman wants α so it rejects p

At [α]% level of significance, we have sufficient evidence to say that the (H_1 scenario) differs.

Failing to Reject Null

$\alpha < p$

-Think packman wants p so it fails to reject p

At [α]% level of significance, we do not have sufficient evidence to say that the (H_1 scenario) differ.

Via Calculator

- Because 2 paired focuses on the difference column, we use T-Test! (Stat → Tests → T-Test)

Given Data:	Given Stats:	
$-d_0$	$-d_0$	$-n$
-Diff. col. (in calc)	$-\bar{d}$	$-H_1$
$-H_1$	$-S$	

Two Sample Independent Testing

Find the information from the problem.

Set A's: $\bar{x}, s, n$; Set B's: $\bar{x}, s, n$; H_0; H_1; α

Determine if the variances are equal.

Finding out via Bartlett's F-Test

1) Which s is bigger? → $S_{bigger} > S_{smaller}$

2) State Hypotheses: $H_0: \sigma_B^2 = \sigma_S^2$ $H_1: \sigma_B^2 > \sigma_S^2$

3) Test Statistic: $TS = F = (s_B^2)/(s_S^2)$

4) p-value: $p = \text{fcdf}(TS, E99, df_B, df_S)$

5 & 6) Decision & Interpret

$\alpha > p$ (Rejecting)	$\alpha < p$ (Failing)
At [α]% L.O.S., we have sufficient evidence to say that the variances are unequal.	At [α]% L.O.S., we do not have sufficient evidence to say that the variances are unequal.

You are told whether they are in the problem.

Make note of whether the scenario is pooled or non-pooled.

$\alpha < p$ $\alpha > p$

State the Hypothesis.

$H_0: \mu_B = \mu_S$

$\underbrace{H_1: \mu_B (> \neq <) \mu_S}_{\text{Direction } H_1 \text{ expresses?}}$

Keeping order from Bartletts if applicable

Find the Test Statistic and p-value via Calculator.

- Formulas are to long, so we use 2-SampTTest for TS & p.

(Stat → Tests → 2-SampTTest)

– May be asked to find p-value for pooled using tcdf.

tcdf(lower, upper, $n_B + n_S - 2$)

- Given data: Lists (in calc), H_1, & pooled? are needed.
- Given stats: $\bar{x}_B$, s_B, n_B, $\bar{x}_S$, s_S, n_S, H_1, & pooled? are needed.

Making a decision and its' interpretation

Rejecting Null

$\alpha > p$

– Think packman wants α so it rejects p

At [α]% L.O.S., we have sufficient evidence to say that [H_1 scenario].

Failing to Reject Null

$\alpha < p$

– Think packman want p so it fails to reject p

At [α]% L.O.S., we do not have sufficient evidence to say that [H_1 scenario].