CONFIDENCE INTERVALS:

Define parameter(s):

Proportions	Means
➢ One sample: p = true **proportion** of… ➢ Two sample: p_1 = true **proportion** of… p_2 = true **proportion** of…	➢ One sample: μ = true **mean** of… ➢ Two sample: μ_1 = true **mean** of… μ_2 = true **mean** of…

Name the procedure:

Proportions	Means
➢ One-sample z-interval for p ➢ Two-sample z-interval for $p_1 - p_2$	➢ One-sample t-interval for μ ➢ Two-sample t-interval for $\mu_1 - \mu_2$

Conditions:

Proportions	Means
➢ One sample: 1) Random sample 2) Independent if $n \le 10\%N$ 3) App Normal if $n\hat{p} \ge 10$ and $n(1-\hat{p}) \ge 10$ ➢ Two sample: 1) Random samples or Assignment 2) Independent if $n_1 \le 10\%N$ & $n_2 \le 10\%N$ 3) Approximately Normal if BOTH: $n_1\hat{p}_1 \ge 10$ and $n_1(1-\hat{p}_1) \ge 10$ & $n_2\hat{p}_2 \ge 10$ and $n_2(1-\hat{p}_2) \ge 10$	➢ One sample: 1) Random sample 2) Independent if $n \le 10\%N$ 3) Approximately Normal if: ➢ Population Normal ➢ $n \ge 30$ by CLT ➢ Sample shows no strong skewness and outliers ➢ Two sample: 1) Random samples or Assignment 2) Independent if $n_1 \le 10\%N$ & $n_2 \le 10\%N$ 3) Approximately Normal if: ➢ BOTH Populations Normal ➢ BOTH $n_1 \ge 30$ & $n_2 \ge 30$ by CLT ➢ BOTH Samples shows no strong skewness and outliers

Interpret a confidence interval:

Proportions	Means
➢ One sample: We are _____% confident that the interval from _____ to _____ captures the true **proportion** of… ➢ Two sample: We are _____% confident that the interval from _____ to _____ captures the true **difference in proportions** of…	➢ One sample: We are _____% confident that the interval from _____ to _____ captures the true **mean** of… ➢ Two sample: We are _____% confident that the interval from _____ to _____ captures the true **difference in means** of…

Interpret a confidence level: In the long run, _____ % of intervals generated capture the population proportion/mean of…

<u>SIGNIFICANCE TESTS</u>:

Write hypotheses (including defining parameters):

Proportions	**Means**
➢ One sample: H_0: p = H_a: p $\neq$, <, or > p = true **proportion** of… ➢ Two sample: H_0: $p_1 = p_2$ H_a: $\neq$, <, or > p_1 = true **proportion** of… p_2 = true **proportion** of…	➢ One sample: H_0: μ = H_a: μ $\neq$, <, or > μ = true **mean** of… ➢ Two sample: H_0: $\mu_1 = \mu_2$ H_a: μ $\neq$, <, or > μ_1 = true **mean** of… μ_2 = true **mean** of…

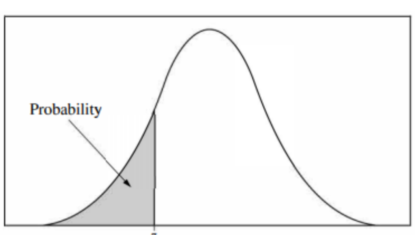
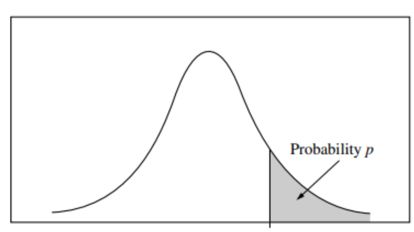
Name the procedure:

Proportions	**Means**
➢ One-sample z-test for p ➢ Two-sample z-test for $p_1 - p_2$	➢ One-sample t-test for μ ➢ Two-sample t-test for $\mu_1 - \mu_2$ ➢ Paired t-test for μ_d

Conditions:

Proportions	**Means**
➢ One sample: 1) Random sample 2) Independent if $n \leq 10\%N$ 3) App Normal if $np_0 \geq 10$ and $n(1-p_0) \geq 10$ ➢ Two sample: 1) Random samples or Assignment 2) Independent if $n_1 \leq 10\%N$ & $n_2 \leq 10\%N$ 3) Approximately Normal if BOTH: $n_1\hat{p}_c \geq 10$ and $n_1(1-\hat{p}_c) \geq 10$ & $n_2\hat{p}_c \geq 10$ and $n_2(1-\hat{p}_c) \geq 10$	➢ One sample: 1) Random sample 2) Independent if $n \leq 10\%N$ 3) Approximately Normal if: ➢ Population Normal ➢ $n \geq 30$ by CLT ➢ Sample shows no strong skewness and outliers ➢ Two sample: 1) Random samples or Assignment 2) Independent if $n_1 \leq 10\%N$ & $n_2 \leq 10\%N$ 3) Approximately Normal if: ➢ BOTH Populations Normal ➢ BOTH $n_1 \geq 30$ & $n_2 \geq 30$ by CLT ➢ BOTH Samples shows no strong skewness and outliers

Use a test statistic to calculate a P-value:

Proportions	**Means**
Test statistic: z 2^{nd} → VARS → normalcdf lower: upper: μ:0 σ:1 Paste  	Test statistic: t* 2^{nd} → VARS → tcdf lower: upper: df: Paste  *df = n – 1

Make a conclusion:

Proportions	Means
➢ One sample: p-value ≤ α , reject H_0. We have convincing evidence that the true **proportion** of…(H_a) p-value > α, fail to reject H_0. We do not have convincing evidence that the true **proportion** of…(H_a) ➢ Two sample: p-value ≤ α , reject H_0. We have convincing evidence that the true **difference in proportions** of…(H_a) p-value > α, fail to reject H_0. We do not have convincing evidence that the true **difference in proportions** of…(H_a)	➢ One sample: p-value ≤ α , reject H_0. We have convincing evidence that the true **mean** of…(H_a) p-value > α, fail to reject H_0. We do not have convincing evidence that the true **mean** of…(H_a) ➢ Two sample: p-value ≤ α , reject H_0. We have convincing evidence that the true **difference in means** of…(H_a) p-value > α, fail to reject H_0. We do not have convincing evidence that the true **difference in means** of…(H_a)

<u>Interpret a P-value</u>: Assuming the H_0 (in context) is true, there is a <u>(*P-value*)</u> probability of getting a sample proportion/mean as extreme or more extreme than <u>(*sample proportion/mean*)</u> by chance alone.

<u>Based on a confidence interval, do we have convincing evidence for a claim?</u>

➢ One sample:
*Compare the claim to the interval. Is the value of the claim inside or outside the interval?
- <u>Example</u>: claim: different than 14, interval (11, 13) → *Because the value 14 is not a plausible value found within the confidence interval, we have convincing evidence that…is different than 14.*
- <u>Example</u>: claim: less than 12, interval (11, 13) → *Because the value 12 is a plausible value found within the confidence interval, we do not have convincing evidence that…less than 12.*

➢ Two sample:
- Because the interval includes 0 as a plausible value for $p_1 - p_2 / \mu_1 - \mu_2$, we do not have convincing evidence that…
- Because the interval does not contain 0, we have convincing evidence that…

<u>WHY do we CHECK Conditions?</u>

➢ **Random:**
- **Random sample:** Generalize the result to the population from which the sample was selected.
- **Random assignment:** Create two groups that are roughly equivalent to allow for a cause-and effect conclusion between the two groups.

➢ **10% Condition:** (Only used if sampling without replacement)
- The sampling is without replacement and thus “dependent.” With less than 10% of the population ($n < 10\%N$), it creates an “essentially independent” environment and makes our standard error valid.

➢ **Normal/Large Counts:**
- Guarantees that the sampling distribution will be approximately normal.
  - **Proportions:** $n\hat{p} \geq 10$ and $n(1-\hat{p}) \geq 10$
    *This allows us to use the normal approximation to estimate the p-value of the test.
  - **Means:** Population is normal, $n \geq 30$ by CLT, or sample shows no strong skewness and outliers
    *This allows us to use a t distribution to estimate the p-value of the test.