

Inference Procedure Summary – AP Statistics

Procedure	Formula	Conditions	Calculator Options
One Sample Mean and Proportion			
Confidence Interval for mean μ when given σ	$\bar{x} \pm z * \frac{\sigma}{\sqrt{n}}$	1. SRS 2. Given value of population standard deviation σ 3. Population distribution is normal (if not stated, use CLT as long as n is large)	<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <pre>ZInterval Inpt:Stats σ:0 List:L1 Freq:1 C-Level:.95 Calculate</pre> </div> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <pre>ZInterval Inpt:Data σ:0 x:19.4 n:5 C-Level:.95 Calculate</pre> </div> </div>
Hypothesis Test for mean μ when given σ ($H_0: \mu = \mu_0$)	$z = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$	SAME AS ABOVE CI	<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <pre>Z-Test Inpt:Stats μs:0 σ:0 List:L1 Freq:1 μ:0 < μs > μs Calculate Draw</pre> </div> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <pre>Z-Test Inpt:Data μs:0 σ:0 x:19.4 n:5 μ:0 < μs > μs Calculate Draw</pre> </div> </div> <p style="font-size: small; margin-top: 10px;">*Can also find p-value using 2nd-Distr normalcdf(lower, upper, mean, sd)</p>
CI for mean μ when σ is unknown	$\bar{x} \pm t * \frac{s}{\sqrt{n}}$ <p style="text-align: center; margin-top: 5px;">with $df = n - 1$</p>	1. SRS 2. Using value of sample standard deviation s to estimate σ 3. Population distribution is given as normal OR $n > 40$ (meaning t procedures are robust even if skewness and outliers exist) OR $15 < n < 40$ with normal probability plot showing little skewness and no extreme outliers OR $n < 15$ with npp showing no outliers and no skewness	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <pre>TInterval Inpt:Stats List:L1 Freq:1 C-Level:.95 Calculate</pre> </div> <div style="border: 1px solid black; padding: 5px;"> <pre>TInterval Inpt:Data x:19.4 sx:12.25969004... n:5 C-Level:.95 Calculate</pre> </div>

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<p>Test for mean μ when σ is unknown ($H_0: \mu = \mu_0$)</p>	$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$ <p>with $df = n - 1$</p>	<p style="text-align: center;">SAME AS ABOVE CI</p>	<div style="border: 1px solid black; padding: 5px; display: flex; justify-content: space-around;"> <div style="font-family: monospace; font-size: 0.8em;"> T-Test Inpt: STAT Stats μs: 0 List: L1 Frc: 1 ut: 0.05 <μs >μs Calculate Draw </div> <div style="font-family: monospace; font-size: 0.8em;"> T-Test Inpt: Data STAT μs: 0 Σ: 19.4 Sx: 12.25969004... n: 5 ut: 0.05 <μs >μs Calculate Draw </div> </div> <p>*Can also find p-value using 2nd-Distr tcdf(lower, upper, df)</p>
<p>CI for proportion p</p>	$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$	<ol style="list-style-type: none"> 1. SRS 2. Population is at least 10 times n 3. Counts of success $n\hat{p}$ and failures $n(1 - \hat{p})$ are both at least 10 (these counts verify the use of the normal approximation) 	<div style="border: 1px solid black; padding: 5px; font-family: monospace; font-size: 0.8em;"> 1-PropZInt x: 0 n: 0 C-Level: .95 Calculate </div>
<p>Test for proportion p ($H_0: p = p_0$)</p>	$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1 - p_0)}{n}}}$	<ol style="list-style-type: none"> 1. SRS 2. Population is at least 10 times n 3. Counts of success np_0 and failures $n(1 - p_0)$ are both at least 10 (these counts verify the use of the normal approximation) 	<div style="border: 1px solid black; padding: 5px; font-family: monospace; font-size: 0.8em;"> 1-PropZTest P0: 0 x: 0 n: 0 PROP: 0.30 <P0 >P0 Calculate Draw </div> <p>*Can also find p-value using 2nd-Distr normalcdf(lower, upper, mean, sd)</p>

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Two Sample Means and Proportions			
CI for mean $\mu_1 - \mu_2$ when σ is unknown	$(\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ with conservative $df = n - 1$ of smaller sample	<ol style="list-style-type: none"> 1. Populations are independent 2. Both samples are from SRSs 3. Using value of sample standard deviation s to estimate σ 4. Population distributions are given as normal OR $n_1 + n_2 > 40$ (meaning t procedures are robust even if skewness and outliers exist) OR $15 < n_1 + n_2 < 40$ with normal probability plots showing little skewness and no extreme outliers OR $n_1 + n_2 < 15$ with np's showing no outliers and no skewness 	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <pre>2-SampTInt Inpt: DATA Stats List1:L1 List2:L2 Freq1:1 Freq2:1 C-Level: .95 ↓Pooled: NO Yes</pre> </div> <div style="border: 1px solid black; padding: 5px;"> <pre>2-SampTInt Inpt: Data Stats x1:0 Sx1:0 n1:0 x2:0 Sx2:0 ↓n2:0</pre> </div>
Test for mean $\mu_1 - \mu_2$ when σ is unknown ($H_0: \mu_1 = \mu_2$)	$t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ with conservative $df = n - 1$ of smaller sample	SAME AS ABOVE CI	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <pre>2-SampTTest Inpt: DATA Stats List1:L1 List2:L2 Freq1:1 Freq2:1 u1: 0 <u2 >u2 ↓Pooled: NO Yes</pre> </div> <div style="border: 1px solid black; padding: 5px;"> <pre>2-SampTTest Inpt: Data Stats x1:0 Sx1:0 n1:0 x2:0 Sx2:0 ↓n2:0</pre> </div> <p style="text-align: center; font-size: small;">*Can also find p-value using 2nd-Distr $\text{tcdf}(\text{lower}, \text{upper}, \text{df})$ where df is either conservative estimate or value using long formula that calculator does automatically!</p>

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<p style="text-align: center;">CI for proportion $p_1 - p_2$</p>	$(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1 - \hat{p}_1)}{n_1} + \frac{\hat{p}_2(1 - \hat{p}_2)}{n_2}}$	<ol style="list-style-type: none"> 1. Populations are independent 2. Both samples are from SRSs 3. Populations are at least 10 times n 4. Counts of success $n_1\hat{p}_1$ and $n_2\hat{p}_2$ and failures $n_1(1 - \hat{p}_1)$ and $n_2(1 - \hat{p}_2)$ are all at least 5 (these counts verify the use of the normal approximation) 	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <pre>2-PropZInt x1:5 n1:20 x2:7 n2:21 C-Level:.95 Calculate</pre> </div>
<p style="text-align: center;">Test for proportion $p_1 - p_2$</p>	$z = \frac{(\hat{p}_1 - \hat{p}_2)}{\sqrt{\hat{p}(1 - \hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ <p style="text-align: center;">where $\hat{p} = \frac{X_1 + X_2}{n_1 + n_2}$</p>	<p>1-3 are SAME AS ABOVE CI</p> <ol style="list-style-type: none"> 4. Counts of success $n_1\hat{p}$ and $n_2\hat{p}$ and failures $n_1(1 - \hat{p})$ and $n_2(1 - \hat{p})$ are all at least 5 (these counts verify the use of the normal approximation) 	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <pre>2-PropZTest x1:5 n1:20 x2:7 n2:21 P1: <P2 >P2 Calculate Draw</pre> </div> <p>*Can also find p-value using 2nd-Distr normalcdf(lower, upper, mean, sd) where mean and sd are values from numerator and denominator of the formula for the test statistic</p>

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Categorical Distributions			
Chi Square Test	$\chi^2 = \sum \frac{(O - E)^2}{E}$ <p style="text-align: center;">G. of Fit – 1 sample, 1 variable Independence – 1 sample, 2 variables Homogeneity – 2 samples, 2 variables</p>	<ol style="list-style-type: none"> 1. All expected counts are at least 1 2. No more than 20% of expected counts are less than 5 	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> χ^2GOF-Test Observed: L1 Expected: L2 df: 5 Calculate Draw </div> <div style="border: 1px solid black; padding: 5px;"> χ^2-Test Observed: [A] Expected: [B] Calculate Draw </div> <p style="font-size: small; margin-top: 10px;">*Can also find p-value using 2nd-Distr χ^2cdf(lower, upper, df)</p>
Slope			
CI for β	$b \pm t^* s_b \text{ where } s_b = \frac{s}{\sqrt{\sum (x - \bar{x})^2}}$ <p style="text-align: center;">and $s = \sqrt{\frac{1}{n-2} \sum (y - \hat{y})^2}$</p> <p style="text-align: center;">with $df = n - 2$</p>	<ol style="list-style-type: none"> 1. For any fixed x, y varies according to a normal distribution 2. Standard deviation of y is same for all x values 	<div style="border: 1px solid black; padding: 5px;"> LinRegTInt Xlist: L1 Ylist: L2 Freq: 1 C-Level: .95 RegEQ: Calculate </div>
Test for β	$t = \frac{b}{s_b} \text{ with } df = n - 2$	SAME AS ABOVE CI	<div style="border: 1px solid black; padding: 5px;"> LinRegTTest Xlist: L1 Ylist: L2 Freq: 1 B & p: μ_0 < 0 > 0 RegEQ: Calculate </div> <p style="font-size: small; margin-top: 10px;">*You will typically be given computer output for inference for regression</p>

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Variable Legend – here are a few of the commonly used variables

Variable	Meaning	Variable	Meaning
μ	population mean mu	CLT	Central Limit Theorem
σ	population standard deviation sigma	SRS	Simple Random Sample
\bar{x}	sample mean x-bar	npp	Normal Probability Plot (last option on stat plot)
s	sample standard deviation	p	population proportion
z	test statistic using normal distribution	\hat{p}	sample proportion p-hat or pooled proportion p-hat for two sample procedures
z^*	critical value representing confidence level C	t^*	critical value representing confidence level C
t	test statistic using t distribution	n	sample size

Matched Pairs – same as one sample procedures but one list is created from the difference of two matched lists (i.e. pre and post test scores of left and right hand measurements)

Conditions – show that they are met (i.e. substitute values in and show sketch of npp) ... don't just list them