**AP Stats: Inference Guidelines Remember to always use PANIC or PHANTOMS during inference!**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | One or Two? | Procedure | Modelchart to use | Parameter use in Ho | Estimate from sample | Formulafor CI or test statistic | Assumptions/Conditions | CalculatorSTAT 🡪TESTS |
| **Proportions**Find z\* on t-distribution at $∝$ row in Confidence Level specified | One sample | 1-proportion z-interval | $$z$$ | $$p$$ | $$\hat{p}$$ | $$\hat{p}\pm z^{\*}∙\sqrt{\frac{\hat{p}\hat{q}}{n}}$$ | IndependentRandom < 10% of populationnp $\geq $ 10 and nq $\geq $ 10 | A: 1-Prop ZInt |
| 1-proportion z-test | $$z=\frac{\hat{p}-p\_{o}}{\sqrt{\frac{p\_{o}q\_{o}}{n}}}$$ | 5: 1-Prop ZTest |
| Two independent groups | 2-proportion z-interval | $$p\_{1}-p\_{2}$$ | $$\hat{p}\_{1}-\hat{p}\_{2}$$ | $$\left(\hat{p}\_{1}-\hat{p}\_{2}\right)\pm z^{\*}∙\sqrt{\frac{\hat{p}\_{1}\hat{q}\_{1}}{n\_{1}}+\frac{\hat{p}\_{2}\hat{q}\_{2}}{n\_{2}}}$$ | IndependentRandom < 10% of populationIndependent groupsnp $\geq $ 10 and nq $\geq $ 10 for both groups | B: 2-Prop ZInt |
| 2-proportion z-test | $$z=\frac{\left(\hat{p}\_{1}-\hat{p}\_{2}\right)-0}{\sqrt{\frac{\hat{p}\_{pool}\hat{q}\_{pool}}{n\_{1}}+\frac{\hat{p}\_{pool}\hat{q}\_{pool}}{n\_{2}}} }$$Where $\hat{\hat{p}\_{pooled}=\frac{\hat{p\_{1}}+\hat{p\_{2}}}{n\_{1}+n\_{2}}}$ | 6: 2-Prop ZTest |
| **Means**With $df=n-1$For 2 groups, use df on calc | One sample | t-interval | $$t$$ | $$μ$$ | $$\overbar{y}$$ | $$\overbar{y}\pm t\_{n-1}^{\*}∙\left(\frac{s}{\sqrt{n}}\right) $$ | Independent Random< 10% of populationNearly Normal | 8: TInterval |
| t-test  | $$t=\frac{\overbar{y}-μ}{\frac{s}{\sqrt{n}}}$$ | 2: T-Test |
| Two independent groups | 2-sample t-interval | $$μ\_{1}-μ\_{2}$$ | $$\overbar{y}\_{1}-\overbar{y}\_{2}$$ | $$\left(\overbar{y}\_{1}-\overbar{y}\_{2}\right)\pm t\_{df}^{\*}∙\sqrt{\frac{s\_{1}^{2}}{n\_{1}}+\frac{s\_{2}^{2}}{n\_{2}}} $$ | Independent (from each other)RandomNearly Normal or large nIndependent groups | 0: 2-SampT int |
| 2-sample t-test | $$t=\frac{\left(\overbar{y}\_{1}-\overbar{y}\_{2}\right)-(μ\_{1}-μ\_{2})}{\sqrt{\frac{s\_{1}^{2}}{n\_{1}}+\frac{s\_{2}^{2}}{n\_{2}}} }$$ | 4: 2-SampT Test |
| Matched pairs | Paired t-interval | $$μ\_{d}$$ | $$\overbar{d}$$ | $$\overbar{d}\pm t^{\*}\_{n-1}∙\frac{s\_{d}}{\sqrt{n}}$$ | Paired data*Differences* in pairs are independentRandom *Differences* nearly Normal | 8: TInterval |
| Paired t-test | $$t\_{n-1}=\frac{\overbar{d}-0}{\frac{s\_{d}}{\sqrt{n}}}$$ | 2: T-Test |
| **Distributions**Categorical | One sample | Goodness of fit | $$χ^{2}$$ | $$χ^{2}$$ |  | $$χ^{2}=\sum\_{}^{}\frac{\left(Obs-Exp\right)^{2}}{Exp}$$df = # of categories – 1  | Counted dataIndependent cellsRandomExp counts $\geq 5$ | D: $χ^{2}$ GOF-Test |
| Many groups | Homogeneity  | $$χ^{2}=\sum\_{}^{}\frac{\left(Obs-Exp\right)^{2}}{Exp}$$df = (rows – 1)(columns – 1) | C: $χ^{2}$-TestMATRIX 🡪 EDIT [A](obs) & [B](exp) |
| **Independence/Association** categorical | Many groups | Independence | Same as above, plus…< 10% of population |
| **Association** slopequantitative | One sample | Linear-Regression conf. interval | $$t$$ | $$β\_{1}$$ | $$b\_{1}$$ | $$b\_{1}\pm t^{\*}\left(SE\_{b}\right)$$df = n–2 | Straight EnoughQuantitative DataRandom/IndependentRandom Residual PlotNearly Normal/No outlier Check histogram of residuals | G: LinRegT Int |
| Linear regression t-test | $$t=\frac{b\_{1}-β\_{1}}{SE\_{b}}$$df = n–2 | F: LinRegT test |

**PANIC**

**P** = Parameters (DEFINE VARIABLES)

**A** = Assumptions (EXPLAIN)

**N** = Name of Interval

**I** = Interval (WORK)

**C** = Conclusion (IN CONTEXT)

**PHANTOMS**

P = Parameters (DEFINE VARIABLES)

H = Hypothesis (Ho, Ha)

A = Assumptions (EXPLAIN)

N = Name of Test

T = Test statistic (WORK)

O = Obtain p-value

M = Make Decision

S = State Conclusion (IN CONTEXT)

**Sample Size**

to find the sample size, always use Margin of Error $ME=CV\*SE$

**Errors**

Type I: Null is true, but we reject it

Type II: Null is false, but we fail to reject it

**All Formulas are set up as**

CI = statistic $\pm $ (critical value)$∙$(standard error)

z or t = $\frac{statistic-null}{SE}$

**Hypotheses for Tests**

* 1-proportion z-test
	+ Ho: $p\geq , \leq , or=$ value
	+ Ha: $p<, >, or\ne $ value
* 2-proportion z-test
	+ Ho: $p\_{1}-p\_{2}=0$
	+ Ha:$ p\_{1}-p\_{2}\ne 0$
* 1-sample t-test
	+ Ho: $μ\geq , \leq , or=$ value
	+ Ha: $μ<, >, or\ne $ value
* 2-sample t-test
	+ Ho: $μ\_{1}-μ\_{2}=0$
	+ Ha: $μ\_{1}-μ\_{2}\ne 0$
* Matched pairs t-test
	+ Ho: $μ\_{d}=0$
	+ Ha: $μ\_{d}\ne 0$
* $χ^{2}$ goodness of fit
	+ Ho: \_\_\_ are uniformly distributed
	+ Ha: \_\_\_ are not uniformly distributed
* $χ^{2}$ test of homogeneity
	+ Ho: \_\_\_ have the same distribution across \_\_\_\_\_\_(categories).
	+ Ha: \_\_\_ do not have the same distribution.
* $χ^{2}$ test for independence
	+ Ho: \_\_\_ and \_\_\_ are independent.
	+ Ha: \_\_\_ and \_\_\_ are not independent.
* Linear Regression t-test
	+ Ho: There is no association between \_\_\_ and \_\_\_. $β\_{1}=0$
	+ Ha: There is an association between \_\_\_ and \_\_\_. $β\_{1}\ne 0$