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Basic Calculator Commands

Type	Use to Find	TI-84 Calculator Commands and Video Links	**Older** Calculator Commands
One Variable	• Mean • Standard deviation • 5 number summary • Expected Value	**STAT→CALC→1-Var Stats** (also shows how to restore lists) **EXPECTED VALUE** Enter data in L1 For Expected Value: Enter the frequencies in L2 List: L1 FreqList: 1 OR For Expected Value: L2	Enter data in L1 For Expected Value: frequency in L2 1-Var Stats L1 For Expected Value: 1-Var Stats L1,L2
	• z-score • p-value	**STAT→TESTS→1: Z-Test** Inpt: Stats μ_0:population mean σ:standard deviation $\bar{x}$: sample mean n: sample size $\mu: \neq \mu \;<\mu \;>\mu$	*<need an older calculator to verify>*
Two Variables	• Equation for a least squares regression line • Correlation (r) and Coefficient of Determination (r^2)	**STAT→CALC→LinReg(ax + b) OR LinReg(a + bx)** **Must do this only once **or** after you clear your calculator memory* *Catalog→DiagnosticOn→enter→enter* *Enter values in L1 (explanatory)* *Enter values in L2 (response)* Xlist: L1 Ylist: L2 FreqList: 1 Store RegEQ: VARS→Y-VARS: 1: Function→1: Y_1	
	• Residuals	Xlist: L1 Ylist: L2 Scroll to the title of one of the empty lists and click 2nd list → RESID	

Probability Distribution Calculator Commands

Type	Use to Find	Formulas	Notation	Newer Calculator Commands
Normal Distribution	• To find area for an interval in a normal distribution	Notation $P(z \leq or \geq \frac{x-\bar{x}}{\sigma}) =$ then use your calculator	normalcdf(lower, upper, mean, SD)	**2nd→VARS→(DISTR)→2: normalcdf** lower: lower bound upper: upper bound μ:mean σ:standard deviation
	• To find a critical value in a normal distribution			**2nd→VARS→(DISTR)→3: invNorm**

Geometric Distribution	• To find the probability of the first success in x trials or less	$P(X = x) = (1 - p)^{x-1}(p)$ $E(X) = \frac{1}{p}$ $\sigma(X) = \sqrt{\frac{1-p}{p^2}}$	geometpdf(p, x)	2nd→VARS→(DISTR)→F: geometcdf p: probability of success x value: number of trials until the first success
	• To find the probability of the first success in exactly x trials or		geometcdf(p, x)	2nd→VARS→(DISTR)→E: geometpdf p: probability of success x value: number of trials until the first success
Binomial Distribution	• To find the probability of getting exactly x successes in a binomial setting	$P(X = x) = {}_nC_x(p)^x(1 - p)^{n-x}$ $E(X) = np$ $\sigma(X) = \sqrt{np(1 - p)}$	binompdf(n, p, x)	2nd→VARS→(DISTR)→A: binompdf trials: number of trials p: probability of success x value: number of successes
	• To find the probability of getting at most X successes in a binomial setting		binomcdf(n, p, x)	2nd→VARS→(DISTR)→B: binomcdf trials: number of trials p: probability of success x value: number of successes
Student's t Distribution	• To find area for an interval in a t distribution		tcdf(lower, upper, df)	2nd→VARS→(DISTR)→6: tcdf lower: lower bound upper; upper bound df: degrees of freedom
	• To find a critical value in a t distribution		invT(area left, df)	2nd→VARS→(DISTR)→4: invT area: desired area df: degrees of freedom
χ^2 Distribution (χ is pronounced kai)	• To find area for an interval in a χ^2 distribution		χ^2cdf(lower, upper, df)	2nd→VARS→(DISTR)→8: χ^2cdf lower: lower bound upper; upper bound df: degrees of freedom

Inference About Proportions

Number of Variables: One **Date Type:** Categorical **Inference About:** Proportions

Number of Samples	Procedure	Model (if conditions are met)	Parameter	Estimate	SE (M.O.E.: $\pm z^* \cdot SE$)	Conditions and Assumptions	Calculator Commands
One Sample	**1 Proportion z-Interval**	Normal Model	p	$\hat{p}$	$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$	**Random:** The data come from a well-designed random sample or randomized experiment. **Normal:** Both $n\hat{p}$ and $n(1 - \hat{p})$ are at least 10 **Independence OR 10%:** Independent or when sampling without replacement check that the population is at least ten times the sample size: $pop \geq 10n$	STAT→TESTS→A **x: number of successes** (not proportion) n: sample size C-Level: confidence level
	1 Proportion z-Test				$\sqrt{\frac{p(1-p)}{n}}$		STAT→TESTS→ 5 p0: null value x: number of successes n: sample size Prop: $\neq p_o$ $<p_o$ $>p_o$ (alternative)
Two *Independent* Samples	**2 Proportion z-Interval**	Normal Model	$p_1 - p_2$	$\hat{p}_1 - \hat{p}_2$	$\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$	**Random:** The data come from two independent random samples or from two groups in a randomized experiment. **Normal/Large Counts:** $n_1\hat{p}_1$, $n_1(1 - \hat{p}_1)$, $n_2\hat{p}_2$, $n_2(1 - \hat{p}_2) \geq$ **Independence OR 10%:** Independent or when sampling without replacement check that $population_1 > 10n_1$ $population_2 > 10n_2$	STAT→TESTS→B x1: number of successes in sample 1 n1: sample size of sample 1 x2: number of successes in sample 2 n2: sample size of sample 2 C-Level: confidence level

	2 Proportion *z*-Test				**Pooled SE** When $p_1 = p_2$ is assumed (eg. H_0): $\sqrt{\hat{p}_c(1-\hat{p}_c)\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$ Where $\hat{p}_c = \frac{x_1 + x_2}{n_1 + n_2}$	**Independent Groups:** The groups are independent of each other.	**STAT→TESTS→6** x1: number of successes sample 1 n1: sample size of sample 1 x2: number of successes sample 2 n2: sample size of sample 2 p1: ≠p2 <p2 >p2 (alternative)

Inference About Means

Number of Variables: One **Date Type:** Quantitative **Inference About:** Means

Number of Samples	Procedure	Model (if conditions are met)	Parameter	Estimate	SE (M.O.E.: $\pm t^* \cdot SE$)	Conditions and Assumptions	Calculator Commands
One Sample	***t*-Interval**	t Distribution with df $= n - 1$	μ	$\bar{x}$	$\frac{s}{\sqrt{n}}$	**Random:** the data come from a well-designed random sample or randomized experiment. **Normal/Large Counts:** the population has a Normal distribution or the sample size is large (n ≥ 30). If the population distribution has an unknown shape and n < 30, use a graph of the sample data to assess the normality of the population. Do not use the t procedures if the graph shows strong skewness or outliers. **Independence OR 10%:** Check that the population is at least ten times the sample size: $pop \geq 10n$	**STAT→TESTS→8** Inpt: Stats (or Data if you entered into a list) $\bar{x}$: sample mean Sx: sample standard deviation n: sample size C-Level: confidence level
	***t*-Test**						**STAT→TESTS→2** Inpt: Stats μ_0: null value $\bar{x}$: sample mean Sx: sample standard deviation n: sample size $\mu \neq \mu_o < \mu_o > \mu_o$ (alternative)
Two *Independent* Samples	**Two Sample *t*-Interval**	t Distribution with df $=$ from TI	$\mu_1 - \mu_2$	$\bar{x}_1 - \bar{x}_2$	$\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}$	**Random:** The data come from two independent random samples or from two groups in a randomized experiment. **Normal/Large Samples:** Both population distributions are Normal or both sample sizes are large ($n_1 > 30$ and $n_2 > 30$). If either population distribution has an unknown shape and the corresponding sample size is less than 30, use a graph of the sample data to assess the normality of the population distribution. Do not use two-sample t procedures if the graph shows strong skewness or outliers. **Independent Groups:** The groups are independent of each other. **Independence OR 10%:** Within each group data is Independent or when sampling without replacement check that $population_1 > 10n_1$ $population_2 > 10n_2$	**STAT→TESTS→0** Inpt: Stats $\bar{x}$1: sample mean of sample 1 Sx1: standard deviation of sample 1 n1: sample size of sample 1 $\bar{x}$2: sample mean of sample 2 Sx2: standard deviation of sample 2 n2: sample size of sample 2 C-Level: confidence level Pooled: No
	Two Sample *t*-Test						**STAT→TESTS→4** Inpt: Stats $\bar{x}$1: sample mean of sample 1 Sx1: standard deviation sample 1 n1: sample size of sample 1 $\bar{x}$2: sample mean of sample 2 Sx2: standard deviation sample 2 n2: sample size of sample 2 $\mu 1: \neq \mu 2 < \mu 2 > \mu 2$ (alternative) Pooled: No
Matched Pairs	***t*-Interval**	t Distribution with df $= n - 1$	μ_d	$\bar{d}$	$\frac{s_d}{\sqrt{n}}$	**Random:** The data come from two independent random samples or from two groups in a randomized experiment. **Independence OR 10%:** Within each group data is Independent or when sampling without replacement check that	**STAT→TESTS→8** Inpt: Stats $\bar{x}$: sample difference of means Sx: sample standard deviation n: sample size C-Level: confidence level

	t-Test							$population_1 > 10n_1$ $population_2 > 10n_2$ **Normal/Large Samples:** Both population distributions are Normal or both sample sizes are large ($n_1 > 30$ and $n_2 > 30$). If either population distribution has an unknown shape and the corresponding sample size is less than 30, use a graph of the sample data to assess the normality of the population distribution. Do not use two-sample t procedures if the graph shows strong skewness or outliers. **Paired Data Assumption:** The two groups are paired.	STAT→TESTS→2 Inpt: Stats μ_0: null value $\bar{x}$: sample difference of means Sx: sample standard deviation n: sample size $\mu \neq \mu_o < \mu_o > \mu_o$(alternative)

χ^2 and Linear Regression

Number of Variables: One or Two **Date Type:** Categorical or Quantitative **Inference About:** Varies

Data Type	Inference About	Number of Samples	Procedure	Model (if conditions are met)	Parameter	Estimate	SE	Conditions and Assumptions	Calculator Commands
One Variable Categorical	Distributions	One Sample	χ2 Goodness of Fit Test	χ^2Distribution with Degrees of Freedom $df = cells - 1$	NA	$\sum \frac{(observed - expected)^2}{expected}$		**Random:** The data come from a well-designed random sample or randomized experiment. **Large Counts:** All data is counted data and all expected counts are at least 5. **Independence OR 10%:** Check that the population is at least ten times the sample size: $pop \geq 10n$	**STAT→TESTS→D** Enter observed counts in L1 Enter expected counts in L2 Observed: L1 Expected: L2 df: degrees of freedom
		Many *Independent* Samples	χ2 Test for Homogeneity	χ^2Distribution with Degrees of Freedom $df = (rows - 1)(cells - 1)$	NA				**STAT→TESTS→C** Enter observed counts in matrix A Observed: [A] Expected: [B] Expected counts appear in matrix B
Two Variables Categorical	Independence	One Sample	χ2 Test for Independence		NA				
Two Variables Quantitative	Association	Two Samples	Linear Regression *t*-Test Confidence Interval for β	T Distribution with Degrees of Freedom $df = n - 2$	β	b	$SE(b)$	**Linear:** The actual relationship between x and y is linear. **Independent:** Individual observations are independent of each other. When sampling without replacement, check the 10% condition. **Normal:** For any fixed value x, the response y varies according to a Normal distribution. **Equal SD:** The standard deviation of y (call it σ) is the same for all values of x. **Random:** The data come from a well-designed random sample or randomized experiment.	**STAT→TESTS→E** Enter values in L1 (explanatory) Enter values in L2 (response) Xlist: L1 Ylist: L2 Freq: 1 $\beta: \neq 0 < 0 > 0$(alternative)

Examples

- Use a one sample t-test when testing **one mean** and **σ is unknown** (σ is never known in real life). Ex. Mrs. Sterken believes that the average student has an IQ of 110, she samples 50 students and finds that the sample has an average IQ of 113 and *calculates from the sample that s = 8*. Is this good evidence that the students at Laney have a higher IQ than 113?

- Also, use a one sample t-test when the data is **matched pairs** and **σ is unknown**. Ex. Mrs. Sterken gives her 19 AP students a pretest on a chapter and then a posttest at the end of the chapter. The average *improvement* was 25 points and she *calculated* that s = 2. Does the instruction time lead to significant evidence of improvement?
- Use a two sample t-test when testing **two means** and **σ is unknown**. Ex. Does the straight wing airplane fly further than the sleek jet?
- Use a one proportion z-test when testing **one proportion**. Ex. You flip a coin 100 times and get 55 tails. Do you have enough evidence to conclude that the coin is biased?
- Use a two proportion z-test when testing **two proportions**. Ex. Are there a greater proportion of middle-aged males that experience heart attacks than middle-aged females?
- Use the Chi-Square Test of Goodness of Fit when **comparing an observed distribution to an advertised distribution.** Ex. Are the M&M's distributed as the company claimed? Are the fruit flavors in Trix cereal distributed uniformly?
- Use the Chi-Square Test for Two-Way Tables to **determine whether there is a relationship or not between the row and column variables**. (Tests for a relationship between 2 categorical variables) Ex. Is there a relationship between whether or not a student smokes based upon whether one parent, both parents, or neither parents smoke?
- Use the test for Homogeneity of Populations when you **have a sample from 2 or more different populations**. Each individual is classified based on a single categorical variable (success or failure in drug rehab program)
- Use the test of Association / Independence when you have **a single sample from a single population** and the individuals are **classified according to two categorical variables**.
- Use a Linear Regression t-test on β (slope) to **determine whether there is a linear relationship between the x and y variables in a scatterplot**. (Tests for a linear relationship between 2 quantitative variables) Ex. Is there a linear relationship between the amount of time a student spends studying for a test and the grade earned on the test?