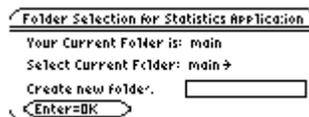


TI-89, TI-92 Plus or Voyage 200 for Non-Business Statistics

Chapter 3

Entering Data

- Press [APPS], select **FlashApps** then press [ENTER]. Highlight **Stats/List Editor** then press [ENTER]. Press [ENTER] again to select the main folder. (Note: If you do not have FlashApps or Stats/List Editor then you can download it from Rachel Webb in NH354B during office hours.)



- Make sure the cursor is in the list, not on the list name and type the desired values pressing [ENTER] after each one. For x-y data pairs, enter all x-values in one list. Enter all corresponding y-values in a second list.



- Press [Home] to return to the home screen.
- To clear a previously stored list of data values, arrow up to the list name you want to clear, press [CLEAR], then press enter.

One Variable Statistics

- Enter the data in list1. Select F4 for the **Calc** menu. Use cursor keys to highlight **1:1-Var Stats**. Type in the name of



your list without space, for example list1. Press enter twice and the statistics will appear in a new window. Use the cursor keys to arrow up and down to see all of the values.

- Note: S_x is the sample standard deviation. The quartiles calculated by the TI calculators differ somewhat from those found using the procedure in the text for this class. Make sure that you do the quartiles by hand.

Sorting Data

- After the data is entered in a list, make sure your cursor is on the list you want to sort. Select F3 List, then select 2:Ops, then select 1:Sort List. Make sure the list number is correct and that Ascending is selected then hi Enter.

Chapter 4

Factorials

- On the home screen, enter the number of which you would like to find the factorial. Press $[2^{nd}] [Math] > 7:Probability > 1:!$. Press [ENTER] to calculate.

Combinations/Permutations

- Press $[2^{nd}] Math > 7:Probability > 2$ for permutation (${}_n P_r$), 3 for combination (${}_n C_r$). Enter the sample size on the home screen, then a comma, then enter the number of "successes" then end the parenthesis. Press [ENTER] to calculate.

Chapter 5

Mean, Variance and Standard Deviation of a Discrete Probability Distribution Table

- Go to the [Apps] **Stat/List Editor**, and type the X values into List 1 and P(X) values into List2.
- Select F4 for the **Calc** menu. Use cursor keys to highlight **1:1-Var Stats**. Type in the name of your X list without space, for example list1 where it says List. Type in the name of your P(X) list without space, for example list2 where

it says Freq. Press enter twice and the statistics will appear in a new window. Use the cursor keys to arrow up and down to see all of the values.

- Note: \bar{X} this is μ the population mean and σ_x is the population standard deviation; square this value to get the variance.

Binomial Distribution

- Go to the [Apps] **Stat/List Editor**, then select F5 [DISTR]. This will get you a menu of probability distributions.
- Arrow down to **binomial Pdf** and press [ENTER]. Enter the values for n, p and x into each cell. Press [ENTER]. This is the probability density function and will return you the probability of exactly x successes. If you leave off the x value and just enter n and p, you will get all the probabilities for each x from 0 to n.
- Arrow down to **binomial Cdf** and press [ENTER]. Enter the values for n, p and lower and upper value of x into each cell. Press [ENTER]. This is the cumulative distribution function and will return you the probability between the lower and upper x-values, inclusive.

Poisson Distribution

- Go to the [Apps] **Stat/List Editor**, then select F5 [DISTR]. This will get you a menu of probability distributions.
- Arrow down to **Poisson Pdf** and press [ENTER]. Enter the values for μ and x into each cell. Press [ENTER]. This is the probability density function and will return you the probability of exactly x successes.
- Arrow down to **Poisson Cdf** and press [ENTER]. Enter the values for μ and the lower and upper values of x into each cell. Press [ENTER]. This is the cumulative distribution function and will return you the probability between the lower and upper x-values, inclusive.

Note: the calculator does not have the hypergeometric or multinomial distributions.

Chapter 6

Normal Distribution

- Go to the [Apps] **Stat/List Editor**, then select F5 [DISTR]. This will get you a menu of probability distributions.
- Arrow down to **Normal Cdf** and press [ENTER]. Enter the values for the lower x value (x_1), upper x value (x_2), μ , and σ into each cell. Press [ENTER]. This is the cumulative distribution function and will return $P(x_1 < x < x_2)$. For example to find $P(80 < X < 110)$ when the mean is 100 and the standard deviation is 20, you should have in the following order 80, 110, 100, 20.
- If you have a z-score, use $\mu = 0$ and $\sigma = 1$, then you will get **standard normal distribution**.
- For a left tail area use a lower bound of negative infinity ($-\infty$), and for a right tail are use an upper bound infinity (∞).

Inverse Normal Distribution

- Go to the [Apps] **Stat/List Editor**, then select F5 [DISTR]. This will get you a menu of probability distributions.
- Arrow down to **Inverse Normal** and press [ENTER]. Enter the area to the left of the x value, μ , and σ into each cell. Press [ENTER]. This will return the percentile for the x value. For example to find the 95th percentile when the mean is 100 and the standard deviation is 20, you should enter .95, 100, 20.
- If you use $\mu = 0$ and $\sigma = 1$, then the default is the **z-score** for the standard normal distribution.

Chapter 7

Confidence Intervals for one sample

- The $100(1 - \alpha)\%$ confidence interval for μ , when σ is known, is $\bar{X} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$. Go to

the [Apps] **Stat/List Editor**, then select 2nd then F7 [Ints], then select **1: ZInterval**.

Choose the input method, **data** is when you have entered data into a list previously or **stats** when you are given the mean and standard deviation already. Type in the

population standard deviation, sample mean, sample size (or list name (list1), and Freq: 1) and confidence level, and press the [ENTER] key to calculate. The calculator returns the answer in interval notation.



- The $100(1 - \alpha)\%$ confidence interval for μ , when σ is unknown, is $\bar{X} \pm t_{n-1, \alpha/2} \frac{s}{\sqrt{n}}$.

Go to the [Apps] **Stat/List Editor**, then select 2nd then F7 [Ints], then select

1:TInterval. Choose the input method, **data** is when you have entered **data** into a list previously or **stats** when you are given the mean and standard deviation already. Type

in the mean, standard deviation, sample size (or list name (list1), and Freq: 1) and

confidence level, and press the [ENTER] key. The calculator returns the answer in interval notation. Be careful, if you accidentally use the [1:ZInterval] option you would get the wrong answer.



- A $100(1-\alpha)\%$ confidence interval for the population proportion p is

$$\hat{p} \pm z_{\alpha/2} \sqrt{\left(\frac{\hat{p}(1-\hat{p})}{n}\right)}$$

Go to the [Apps] **Stat/List Editor**, then select 2nd then F7 [Ints], then select **5: 1-PropZInt**. Type in the values for X, sample size and confidence level, and press the [ENTER] key. The calculator returns the answer in interval notation. Note: sometimes you are not given the x value but a percentage instead. To find the x value to use in the calculator, multiply \bar{p} by the sample size and round off to the nearest integer. The calculator will give you an error message if you put in a decimal for x or n. For example if $\bar{p} = .22$ and $n = 124$ then $.22*124 = 27.28$, so use $x = 27$.



- Note: you cannot do the chi-squared confidence interval for one variance on the TI-89.

Chapter 8

Hypothesis testing for one sample

- Hypothesis test for a population mean when σ is known, test statistic is $Z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}}$.

Go to the [Apps] **Stat/List Editor**, then select 2nd then F6 [Tests], then select **1: ZTest**. Choose the input method, data is when you have entered data into a list previously or stats when you are given the mean and standard deviation already. Type in the hypothesized mean (μ_0), population standard deviation, sample mean, sample size, (or list name



(list1), and Freq: 1), arrow over to the $\neq, <, >$ sign and select the same as the problems alternative hypothesis statement then press the [ENTER] key to calculate. The calculator returns the z-test statistic and p-value.

- Hypothesis test for a population mean when σ is unknown, test statistic is $t = \frac{\bar{X} - \mu_0}{s/\sqrt{n}}$.

Go to the [Apps] **Stat/List Editor**, then select 2nd then F6 [Tests], then select **2: T-Test**. Choose the input method, data is when you have entered data into a list previously or stats when you are given the mean and standard deviation already. Then type in the

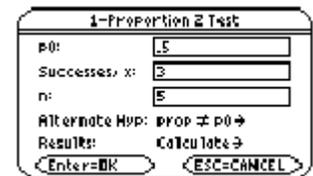


hypothesized mean (μ_0), sample standard deviation, sample mean, sample size, (or list name (list1), and Freq: 1),

arrow over to the $\neq, <, >$ and select the sign that is the same as the problems alternative hypothesis statement then press the [ENTER] key to calculate. The calculator returns the t-test statistic and p-value.

- Hypothesis test for one sample population proportion, test statistic is $Z = \frac{\hat{p} - p_0}{\sqrt{\left(\frac{p_0(1-p_0)}{n}\right)}}$. Go to the [Apps]

Stat/List Editor, then select 2nd then F6 [Tests], then select **5: 1-PropZ-Test**. Type in the hypothesized proportion (p_0), x, sample size, arrow over to the $\neq, <, >$ sign that is the same in the problems alternative hypothesis statement then press the [ENTER] key to calculate. The calculator returns the z-test statistic and the p-value. Note: sometimes you are not given the x value but a percentage instead. To find the x value to use in the calculator, multiply \bar{p} by the sample size and round off to the nearest integer. The



calculator will give you an error message if you put in a decimal for x or n. For example if $\bar{p} = .22$ and $n = 124$ then $.22*124 = 27.28$, so use $x = 27$.

- Note: you cannot do the chi-squared test for one variance on the TI-89.

Chapter 9

9.1 Confidence Interval and Hypothesis Test for Two Population Means Large Independent Samples

- Hypothesis test for the difference between the means of two populations $\mu_1 - \mu_2$,

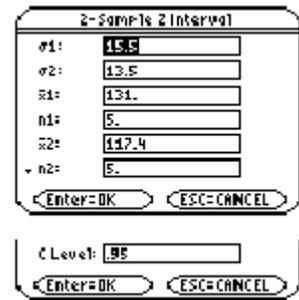
independent samples, σ_1 and σ_2 is known, test statistic is $z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{\sigma_1^2}{n_1}\right) + \left(\frac{\sigma_2^2}{n_2}\right)}}$. Go



to the [Apps] **Stat/List Editor**, then select 2nd then F6 [Tests], then select **3: 2-SampZ-Test**. Then type in the population standard deviations, the first sample mean and sample size, then the second sample mean and sample size, (or list names (list3 & list4), and Freq1:1 & Freq2:1), arrow over to the \neq , $<$, $>$ sign that is the same in the problems alternative hypothesis statement then press the [ENTER] key to calculate. The calculator returns the z-test statistic and the p-value.

- The 100(1 - α)% confidence interval for the difference between the means of two

populations $\mu_1 - \mu_2$, independent samples, is $(\bar{X}_1 - \bar{X}_2) \pm z_{\alpha/2} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$. Go



to the [Apps] **Stat/List Editor**, then select 2nd then F5 [Ints], then select **3: 2-SampZInt**. Then type in the population standard deviations, the first sample mean and sample size, then the second sample mean and sample size, (or list names (list3 & list4), and Freq1:1 & Freq2:1), then enter the confidence level. To calculate press the [ENTER] key. The calculator returns the confidence interval.

9.2 Confidence Interval and Hypothesis Test for Two Population Means Small Independent Samples

- The 100(1 - α)% confidence interval for the difference between the means of two populations $\mu_1 - \mu_2$, independent samples, σ_1 and σ_2 are unknown is

$(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$. Go to the [Apps] **Stat/List Editor**, then select 2nd then F5



[Ints], then select **4: 2-SampTInt**. Enter the sample means, sample standard deviations, sample sizes, (or list names (list3 & list4), and Freq1:1 & Freq2:1), confidence level. Highlight the No option under Pooled. Press the [ENTER] key to calculate. The calculator returns the confidence interval.

- Hypothesis test for the difference between the means of two populations $\mu_1 - \mu_2$, independent samples, σ_1 and σ_2 are unknown. The test statistic is

$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{S_1^2}{n_1}\right) + \left(\frac{S_2^2}{n_2}\right)}}$. Go to the [Apps] **Stat/List Editor**, then select 2nd then F6



[Tests], then select **4: 2-SampT-Test**. Enter the sample means, sample standard deviations, and sample sizes, (or list names (list3 & list4), and Freq1:1 & Freq2:1). Then arrow over to the not equal, $<$, $>$ and select the sign that is the same in the problems alternative hypothesis statement. Highlight the No option under Pooled. Press the [ENTER] key to calculate. The calculator returns the t-test statistic and the p-value.

9.3 Confidence Interval and Hypothesis Test for Small Dependent Samples (Matched Pairs)

- Hypothesis test for the difference between the means of two populations μ_d for dependent samples (matched pairs)

test statistic is $t = \frac{\bar{D} - \mu_D}{\frac{S_D}{\sqrt{n}}}$. First find the differences between the samples. Go to the [Apps] **Stat/List Editor**, then

enter the differences into list 1. Select 2nd then F6 [Tests], then select **2: T-Test**. Select the [Data] menu. Then type in the hypothesized mean as 0, List: list1, Freq:1, arrow over to the \neq , $<$, $>$ and select the sign that is the same in the

problems alternative hypothesis, press the [ENTER] key to calculate. The calculator returns the t-test statistic, p-value, $\bar{X} = \bar{D}$ and $S_x = S_D$.

- The $100(1 - \alpha)\%$ confidence interval for the difference between the means of two populations μ_d , dependent samples (matched pairs), is $\bar{D} \pm t_{n-1, \alpha/2} \frac{S_D}{\sqrt{n}}$. First find the differences between the samples.

Go to the [Apps] **Stat/List Editor**, then enter the differences into list 1. Select 2nd then F7 [Ints], then select **2: T-Interval**. Select the [Data] menu. Enter in List: list1, Freq:1. Then type in the confidence level. Press the [ENTER] key to calculate. The calculator returns the confidence interval.



9.4 Confidence Interval and Hypothesis Test for Two Population Proportions

- Hypothesis test for the difference between the proportions of two populations $p_1 - p_2$, test statistic is $Z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\bar{p}(1 - \bar{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$. Go to the [Apps] **Stat/List Editor**, then

select 2nd then F6 [Tests], then select **6: 2-PropZTest**. Type in the x_1, n_1, x_2, n_2 , arrow over to the $\neq, <, >$ and select the sign that is the same in the problems alternative hypothesis statement. Press the [ENTER] key to calculate. The calculator returns the z-test statistic, sample proportions, pooled proportion, and the p-value.



- The $100(1 - \alpha)\%$ confidence interval for the difference between the proportions of two populations $p_1 - p_2$ is

$$(\hat{p}_1 - \hat{p}_2) \pm Z_{\alpha/2} \sqrt{\frac{\hat{p}_1(1 - \hat{p}_1)}{n_1} + \frac{\hat{p}_2(1 - \hat{p}_2)}{n_2}}$$

Go to the [Apps] **Stat/List Editor**, then select 2nd then F7 [Ints], then select **6: 2-PropZInt**. Type in the x_1, n_1, x_2, n_2 , the confidence level, then press the [ENTER] key to calculate. The calculator returns the confidence interval.

9.5 Hypothesis Test For Two Population Variances

- Hypothesis test for two population variances or standard deviations, test statistic is $F = \frac{s_1^2}{s_2^2}$. Go to the [Apps] **Stat/List Editor**, then select 2nd then F6 [Tests], then

select **9: 2-SampFTest**. Then type in the s_1, n_1, s_2, n_2 , (or list names list1 & list2), select the sign, $\neq, <, >$ that is the same in the problems alternative hypothesis statement, press the [ENTER] key to calculate. The calculator returns the F-test statistic and the p-value.



Chapter 10

Simple linear regression.

- Go to the [Apps] **Stat/List Editor**, then type in the x-values into list1 and the y-values into list2. Select 2nd then F6 [Tests], then select **A:LinRegTTest**. Enter the following, Xlist: **list1**; Y List: **list2**; Freq: **1**, select the alternative hypothesis as $\beta \text{ \& } \rho \neq 0$, store results to: none. Press the [ENTER] key to calculate.

The calculator returns the t-test statistic, the y-intercept a, slope b, $s = \sqrt{MSE}$, R^2 , and r.

- For an F-test use the Multiple Regression test with only one x list, (independent variables = 1).



Chapter 11

Goodness of Fit Test

- Hypothesis test for three or more proportions (goodness of fit test). Go to the [Apps] **Stat/List Editor**, then type in the observed values into list 1, and the expected values into list 2. Select 2nd then F6 [Tests], then select **7: Chi-2GOF**. Type in the list names and the degrees of freedom (df = k-1). Then press the [ENTER] key to calculate. The calculator returns the χ^2 -test statistic and the p-value.

Test for Independence Hypothesis test for the independence of two variables (contingency tables).

- First you need to create the matrix for the observed values: Press: [Home] to return to the Home screen, press [Apps] and select **6:Data/Matrix Editor**. A menu is displayed, select **3:New**. The **New** dialog box is displayed. Press the right arrow key to highlight **2:Matrix**, and press [ENTER] to choose **Matrix** type. Press the down arrow key to highlight **1:main**, and press [ENTER], to choose **main** folder. Press the down arrow key, and then enter the name **o** in the **Variable** field. Enter **3** for **Row dimension** and **2** for **Column dimension**. Press [ENTER] to display the matrix editor. Enter **4, 9, 5** in **c1** and **7, 2, 3** in **c2**. Press \blacklozenge [Apps] [ENTER] to close the matrix editor and return to the list editor. If you have more than one Application loaded, press \blacklozenge [Apps], and then select **Stats/List Editor**.
- To display the **Chi-square 2-Way** dialog box, press 2nd then F6 [Tests], then select **8: Chi-2 2-way**. Enter in in the Observed Mat: **o**; Store Expected to: **statvars\e**; Store CompMat to: **statvars\c**. This will store the expected values in the matrix folder statvars with the name e, and the $(o-e)^2/e$ values in the matrix c. Press the [ENTER] key to calculate. The calculator returns the χ^2 -test statistic and the p-value. If you go back to the matrix menu you will see all of the expected and $(o-e)^2/e$ values.

Chapter 12

Analysis of Variance

- ANOVA, hypothesis test for the equality of k population means.). Go to the [Apps] **Stat/List Editor**, then type in the data for each group into a separate list, (or if you don't have the raw data, enter the sample size, sample mean and sample variance for group 1 into list1 in that order, repeat for list2, etc). Select 2nd then F6 [Tests], then select **C:ANOVA**. Select the input method **data** or **stats**. Select the number of groups. Press the [ENTER] key to calculate. The calculator returns the F-test statistic, the p-value, Factor (Between) df, SS and MS, Error (Within) df, SS and MS. The last value Sxp is the square root of the MSE.
- The calculator will also do a Two-way ANOVA block design.