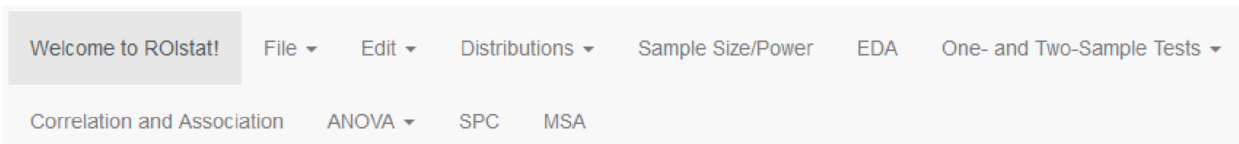
Using ROIstat

Once ROIstat is installed and running, here is how to use it for the various lessons in the book.

The Basics

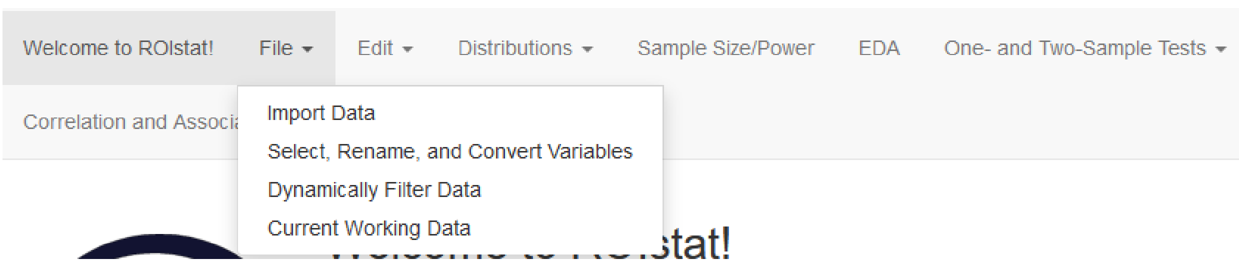
ROIstat is an app that is set up to have a familiar user interface.

Along the top you have a familiar menu set up:



File

Clicking on **File** will bring up these options:

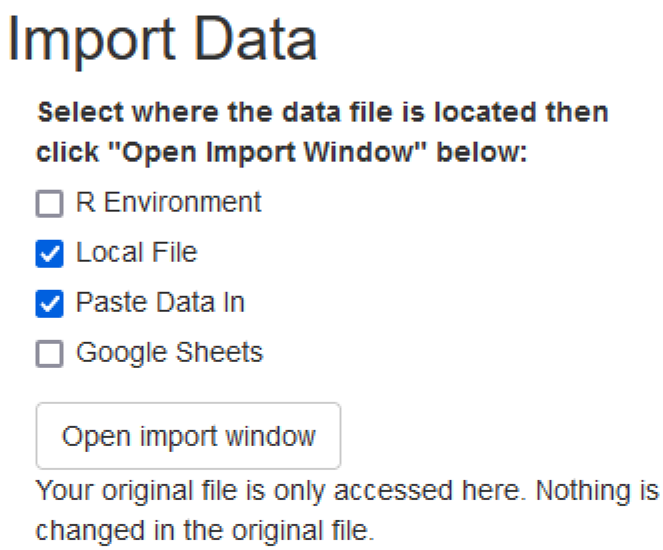


Import Data

ROIstat can import data from:

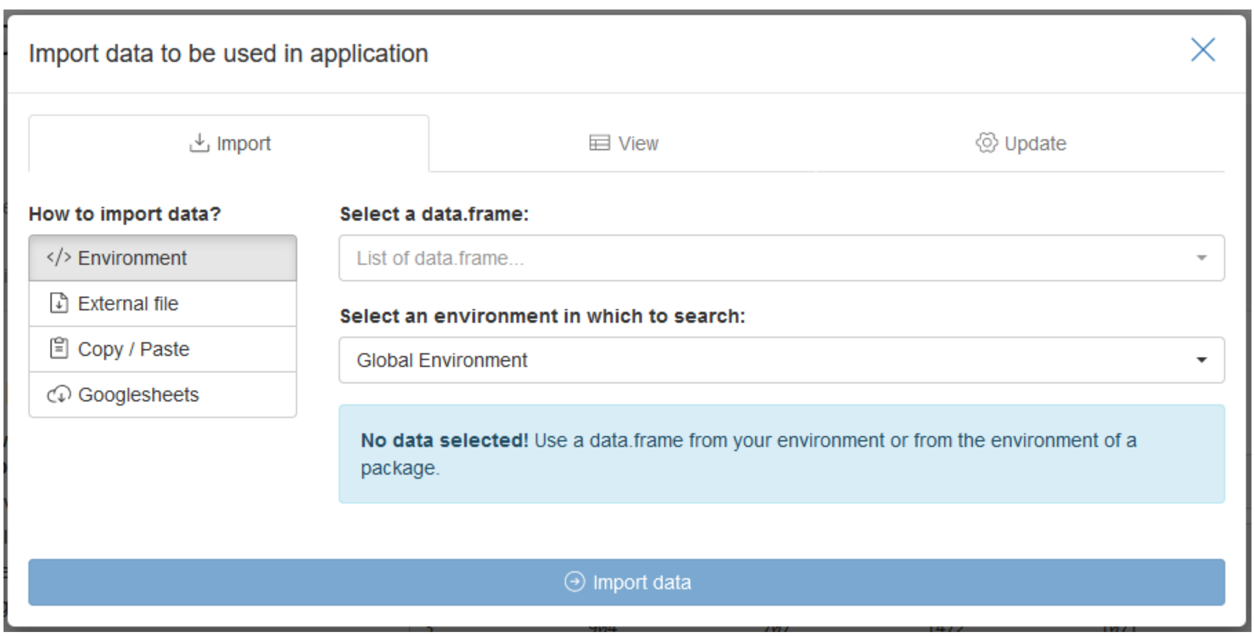
- The **R Environment** – this is useful if you are working in both R and ROIstat, perhaps using R for data manipulation and ROIstat for the analysis.
- **Local File** – this is just a file that is on your computer somewhere. There are a large number of formats that can be imported (anything rio can import, ROIstat can), so you can use most plain data files as well as save files from a number of analysis programs. You may need to select "All Files" rather than "All Supported Types" when you get to the File Upload page to see them.
- **Paste Data In** – If you have copied data from a spreadsheet or word processor, you can paste it directly into a window and ROIstat will do its best to parse it into a data file.
- **Google Sheets** – If you have data stored in Google Sheets, you can import it directly into ROIstat.

The Local File and Paste Data In options are pre-selected, since they are the most common, but you can activate the other two just by clicking the check box next to their names:

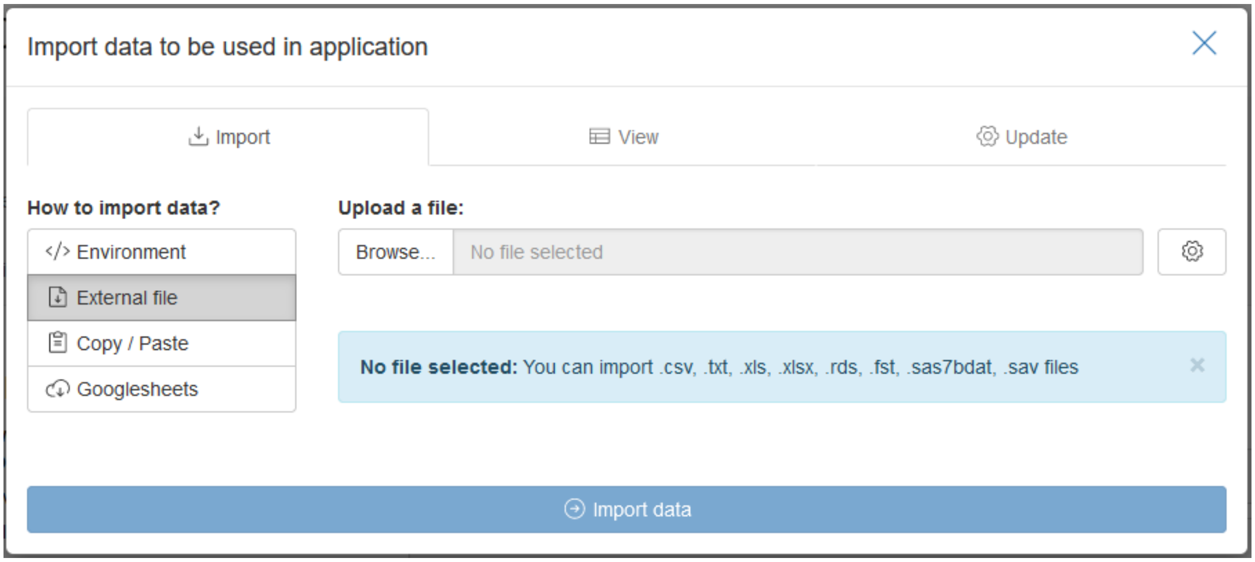


Once you click the **Open Import Window** button above, you will see your active options for importing the data. Select your option and the import window will change to accommodate your choice.

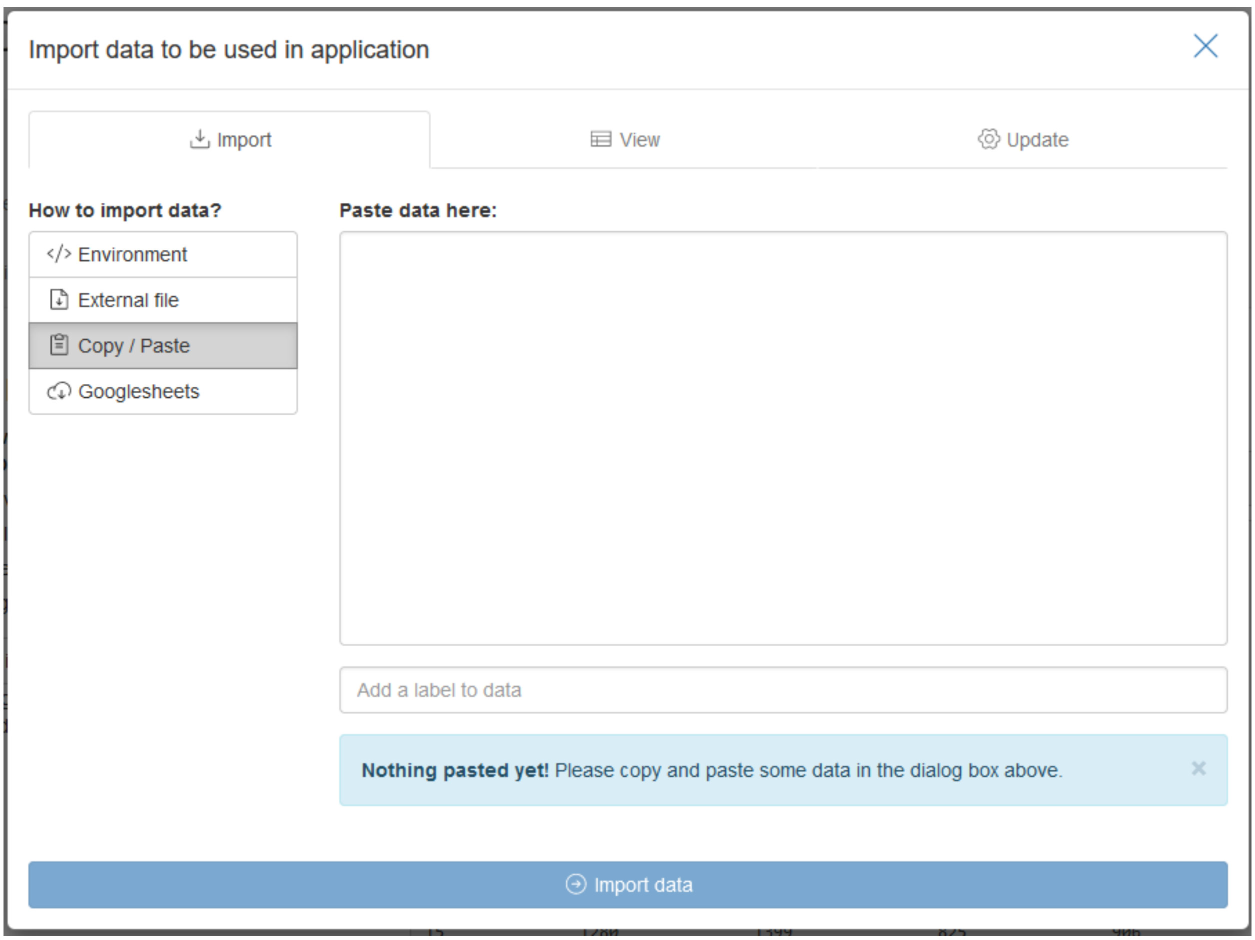
For the **R Environment** it will have a drop-down list of the data frames that are in the selected environment. All you have to do is select the one you want:



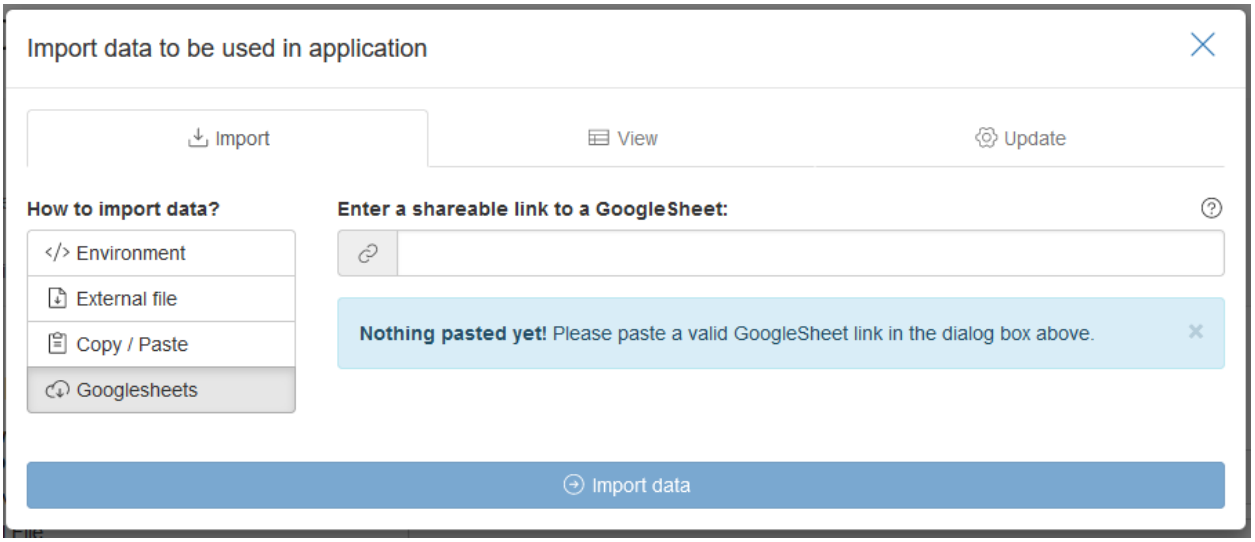
For **External files** you will see the familiar Browse button interface that will allow you to navigate to the folder where the data are stored:



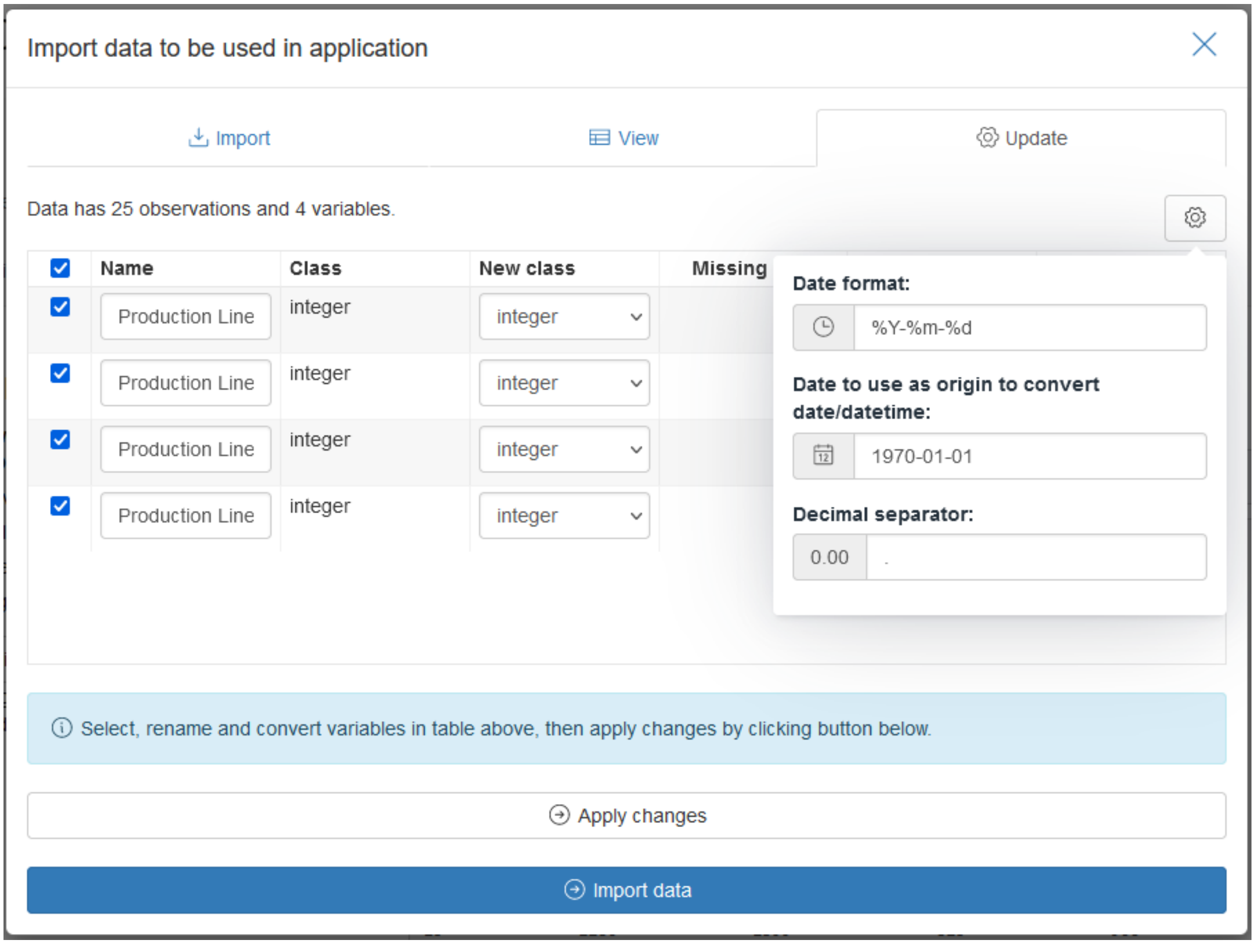
To **Copy/Paste**, just paste what you have in the box:



And for **Google Sheets**, just enter the link to the file:



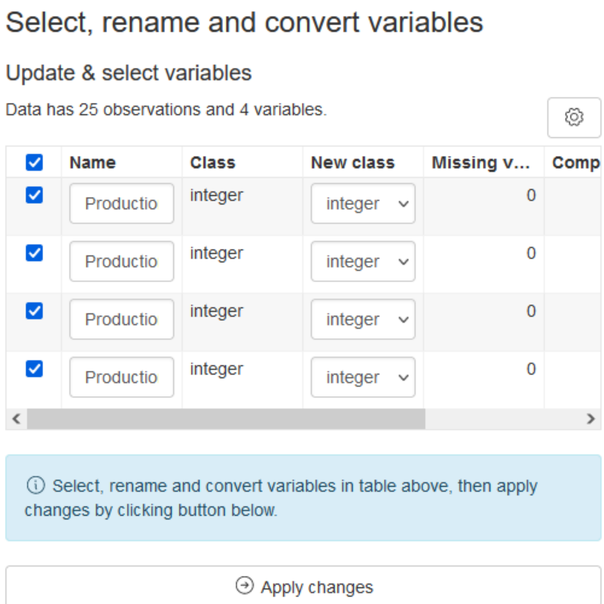
You can also click on the **View** tab to see the data you have selected before importing it. The **Update** tab allows you to change the names or classes, see if there is missing data, and choose different date and time formats or decimal separators to handle whatever the specifics of your file might be. You can also deselect variables to be imported. Click **Apply Changes** to use the new settings.

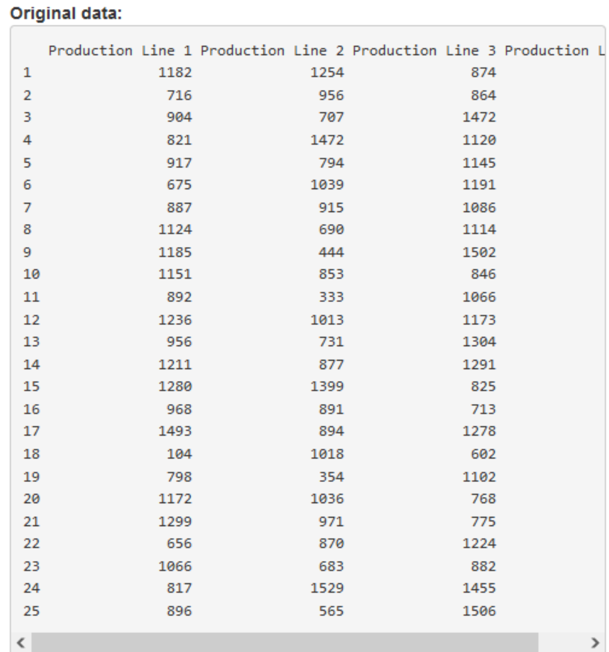


Clicking on **Import Data** will bring a copy of the data into ROIstat. Note that nothing you do in ROIstat changes the original file.

Select, Rename, and Convert Variables

This provides the same function as the **Update** tab did in **Data Import**, namely you can change the name, class and formats of the data you have imported. This page also gives you a snapshot of the data you have loaded as well as the data after the changes you have made are executed. If you want to reduce the number of columns of data, deselected the check box next to the name of the data. It doesn't delete it, but it will not show up when selecting data in the app. It is a quick way to declutter if you have a big data set. You again have to click **Apply Changes** for them to take effect.




Original data:

	Production Line 1	Production Line 2	Production Line 3	Production L
1	1182	1254	874	
2	716	956	864	
3	904	707	1472	
4	821	1472	1120	
5	917	794	1145	
6	675	1039	1191	
7	887	915	1086	
8	1124	690	1114	
9	1185	444	1502	
10	1151	853	846	
11	892	333	1066	
12	1236	1013	1173	
13	956	731	1304	
14	1211	877	1291	
15	1280	1399	825	
16	968	891	713	
17	1493	894	1278	
18	104	1018	602	
19	798	354	1102	
20	1172	1036	768	
21	1299	971	775	
22	656	870	1224	
23	1066	683	882	
24	817	1529	1455	
25	896	565	1506	

Dynamically Filter Data

This allows you to perform some simple filtering on your data sets. If the column is marked as integer, numeric or date, it will give you a slider with a lower and upper marker. This will allow you to set lower and upper filters for each column. If there is missing data, it will give you the option to delete each row with missing data.

Current Working Data

This shows you the data as selected and filtered by the previous steps.

Edit Settings

Here you can change the default color palette for ROIstat. The default “R4” color palette is usually adequate for most uses and accommodates most color-blind users. Drop down the list to choose other palettes including Okabe-Ito for color vision deficiencies. A demo of the colors is shown for each selection in a graph below.

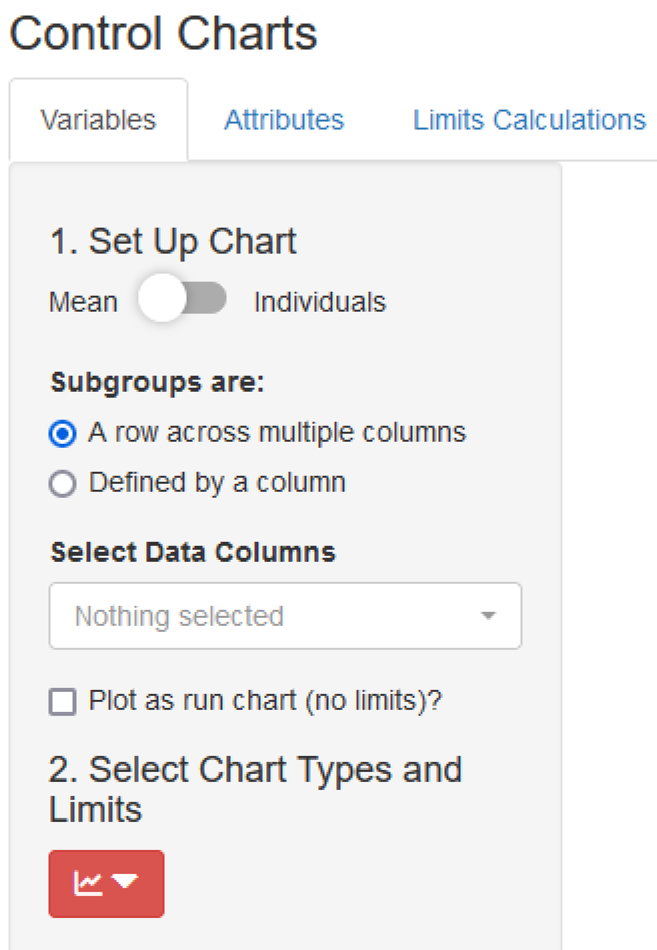
Using ROIstats in *Data-Driven Leadership*

From now on, I’ll show you how to use ROIstats to replicate the activities in Data-Driven Leadership. I’ll just go through in order. Anything in **bold** indicates something that you will see or select in the app.

Chapter 3 – Understanding and Presenting Data

Making a Run Chart

Once you load **PRODUCTION.CSV**, select the **SPC** menu item. You will see this:



This allows you to set up run charts and statistical process control (SPC) charts. We are only looking to set up a run chart to start with.

Step 1 is to set up the chart. Since the data is a list of individual observations, select **Individuals**. Next you need to specify which column you want to chart. In the book it was Production Line 2, so choose that in the drop down labeled **Select Data Column**. You can leave the **Select Set Column** on None.

Now select the **Plot as run chart (no limits)?** checkbox. After a moment it will create the chart. You can hover your mouse over a point to see information about it.

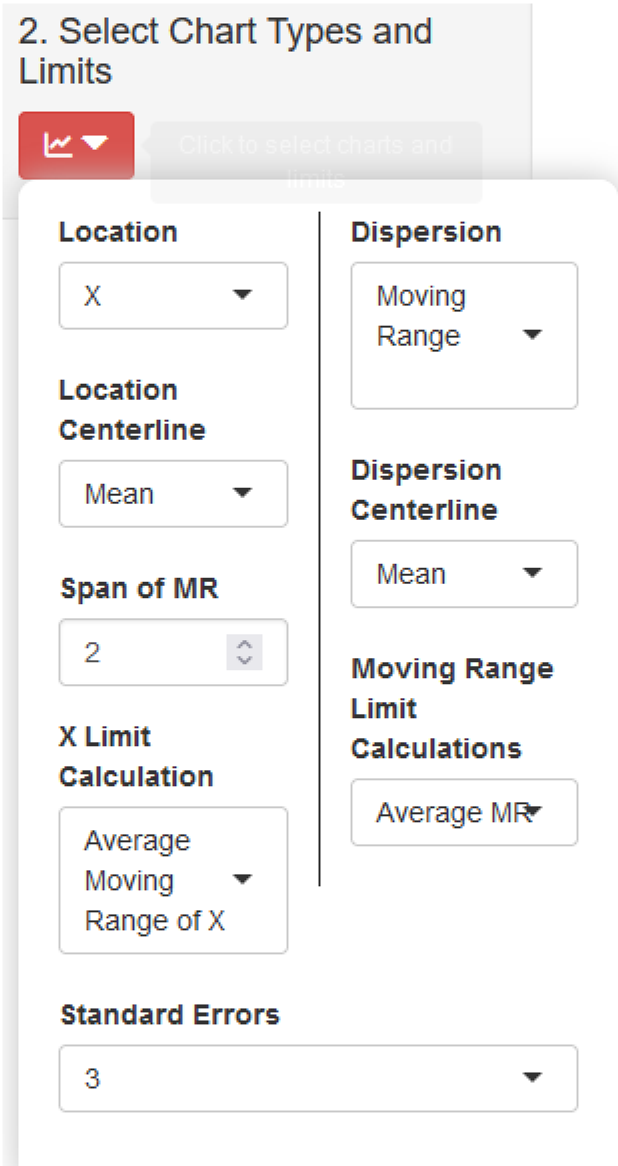
You can change where the centerline is by selecting either the mean or the median on the slider switch. You can adjust the base font size to make the numbers and labels larger or smaller. You can select a variety of formats to download the graph.

Making a Control Chart

Choosing the right chart and the right calculation for limits for control charts is a whole topic by itself, but here is how to make the ones in the book.

If you have just made the run chart as above, unselect the checkbox. Step 2 – Select Chart Types and Limits will appear. Otherwise, make sure that **Individuals** is selected and you have chosen Production Line 2 as the data column.

Click on the dropdown icon to get a list of the various ways you can make control charts. Once you do that, a chart will be plotted. By default, it will have the following selections, which are correct for this example.



Click on the dropdown button again to hide the limits selection box.

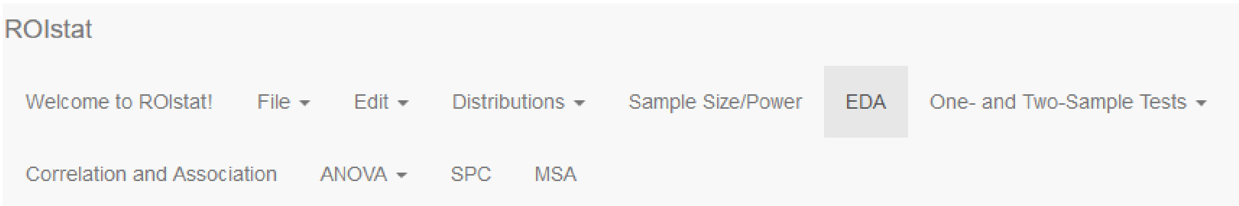
By changing the data column, you can plot Production Line 1 with its special cause.

There are a variety of customizations you can make to the chart here:

The gear dropdown menu allows you to customize which pattern detection rules the control chart uses and which features are used on the graph. The **Show Analysis** slider performs a number of analyses on the chart. The **Show Plot Data** slider creates a table with the data in case you want to copy and paste that and create a custom chart of your own. The Decimals box controls the number of decimals displayed throughout.

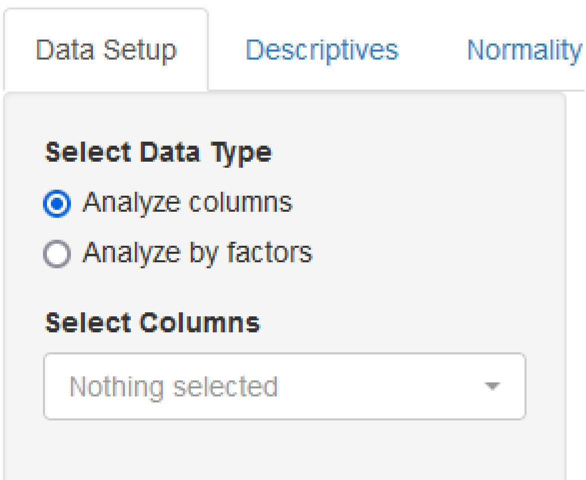
Getting Statistics

A quick way to get statistics from your loaded data is to click on the **EDA** menu item.



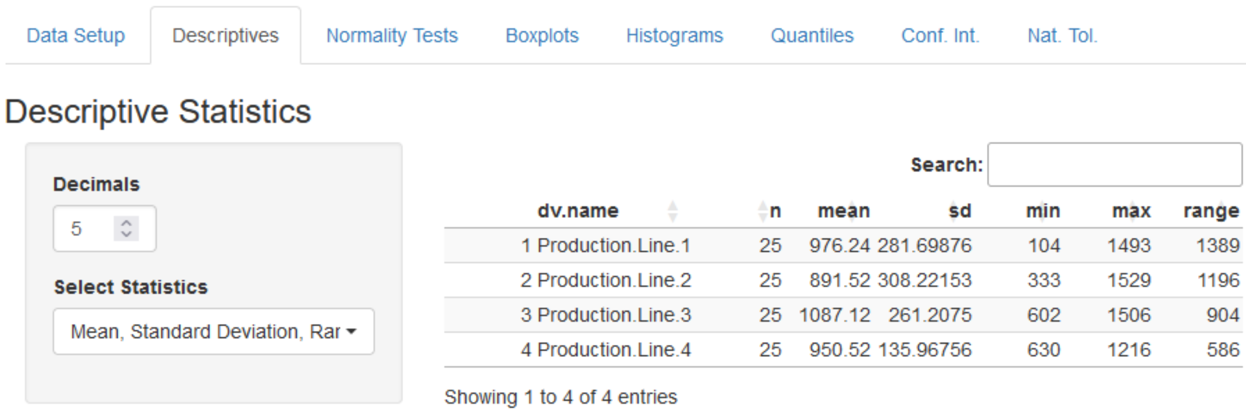
EDA stands for "Exploratory Data Analysis" and it is often the first step to get to know your data set.

When you first enter EDA, you will have to tell the app how your data is structured.



In the case of PRODUCTION.CSV, each column is a production line, so we want to analyze by columns. Clicking on the **Select Columns** dropdown will show all the columns. You can click one or more of these to explore. As you add data you will see a sample of the data appear to the right. This is helpful to see if you have the data you expected selected.

If you then click on the Descriptives tab, you will get a variety of common descriptive statistics.



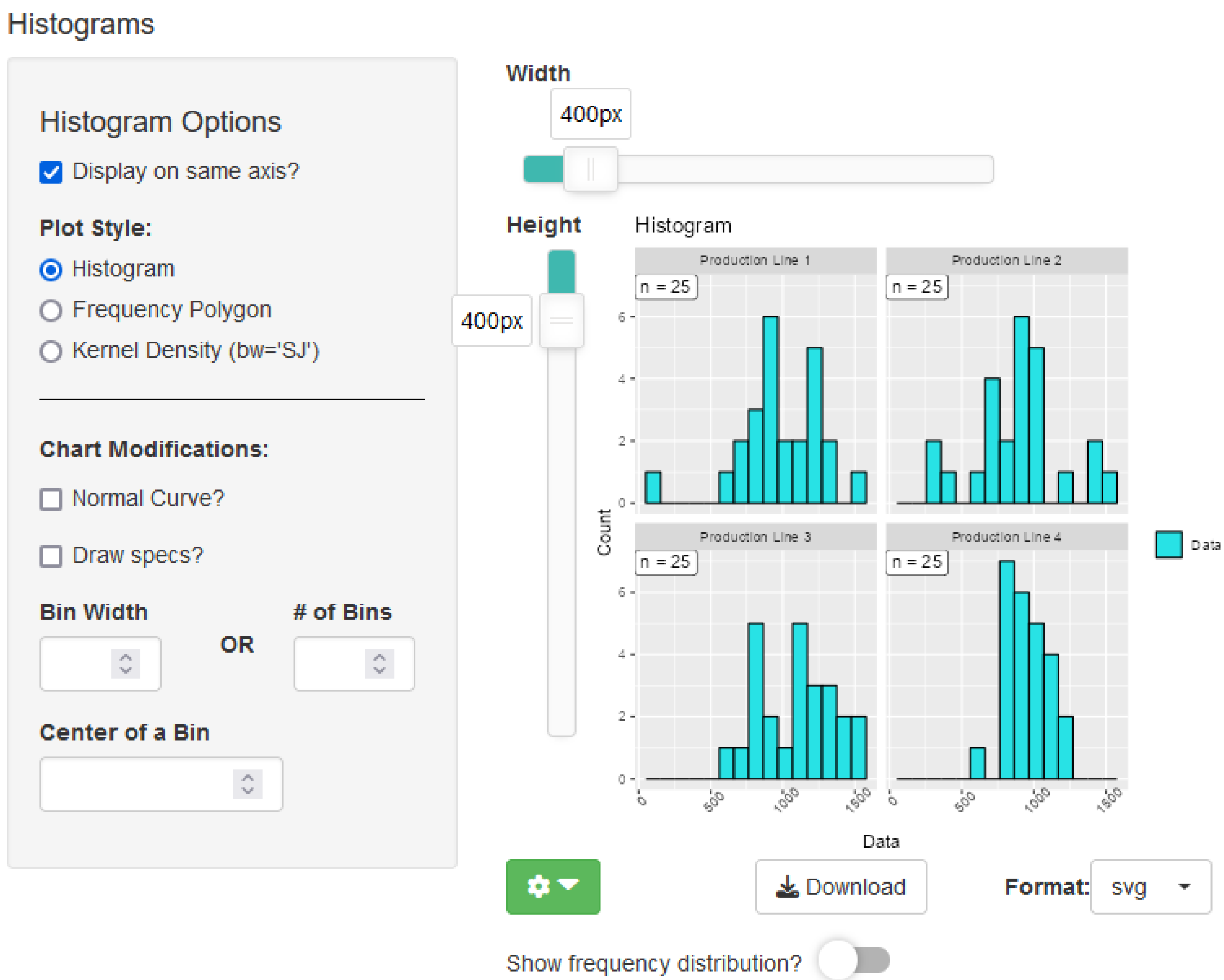
	dv.name	n	mean	sd	min	max	range
1	Production.Line.1	25	976.24	281.69876	104	1493	1389
2	Production.Line.2	25	891.52	308.22153	333	1529	1196
3	Production.Line.3	25	1087.12	261.2075	602	1506	904
4	Production.Line.4	25	950.52	135.96756	630	1216	586

Showing 1 to 4 of 4 entries

The **Decimals** box controls the number of decimals displayed. If you wish to add or remove to the statistics displayed, click on the **Select Statistics** dropdown list. You will find a comprehensive list of statistics grouped by type. If you select a large number of statistics to display, the table will extend to the right, and you may have to scroll the window to see them all.

Making a Histogram

Histograms are also created in the EDA menu item. Once you have set up your data, click on the **Histograms** tab.



If you have more than one group you are graphing, the app will wrap them as above. If you want to compare the different groups of data on the same access, make sure that **Display on same axis?** is checked. If your groups are at different scales, unchecking this will graph each group on whatever scale makes sense for it.

You can select which type of plot by clicking on the radio buttons under **Plot Style**.

You can add a normal curve or specifications by checking those boxes.

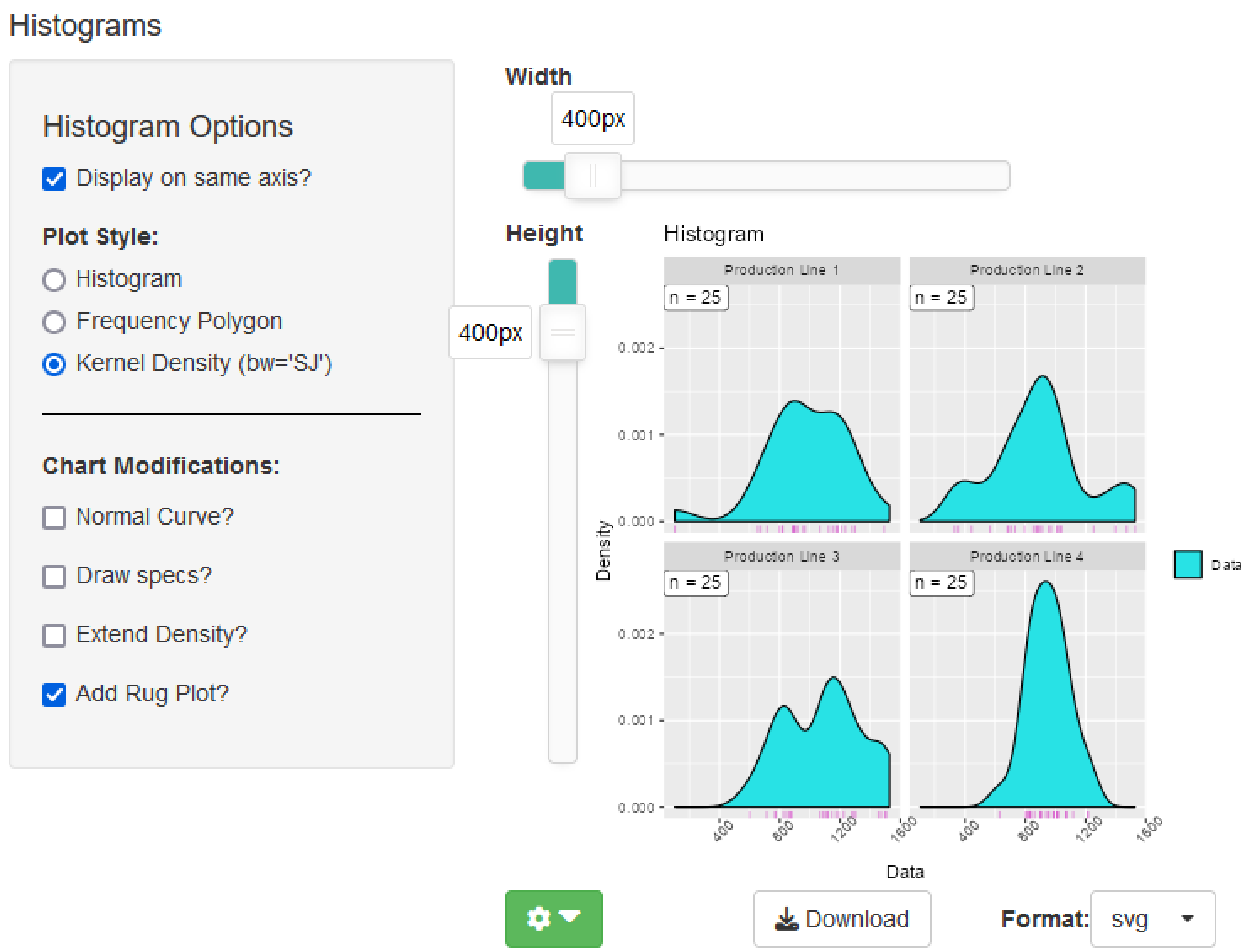
You can modify the histograms by changing the bin width or the number of bins as well as the center point of a bin.

You can change the size of the histogram by using the slider on the top to change width and the side to change height.

You can customize the title and x-axis label as well as increase the size of the font in the gear dropdown menu.

The slider switch **Show frequency distribution?** Will create a frequency distribution table based on your selections under chart modifications.

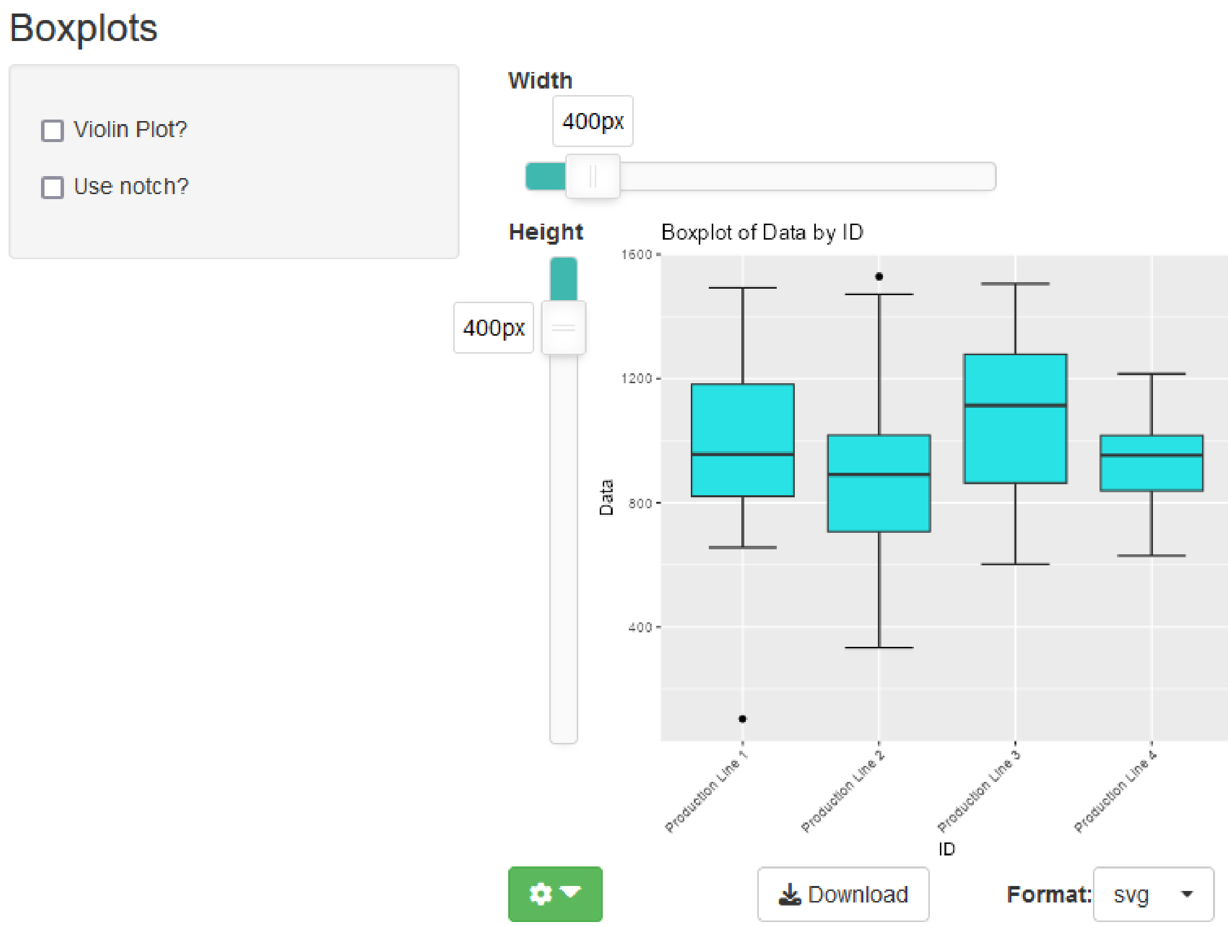
If you select the **Kernal Density** plot, different options will appear. In addition to being able to add the **Normal Curve** and **Draw Specs**, you can **Extend the Density** beyond the observed values and **Add a Rug Plot**.



You can select the format and download the graphic.

Making a Boxplot

Boxplots are created in the EDA menu item. Once you have set up your data, click on the **Boxplot** tab.

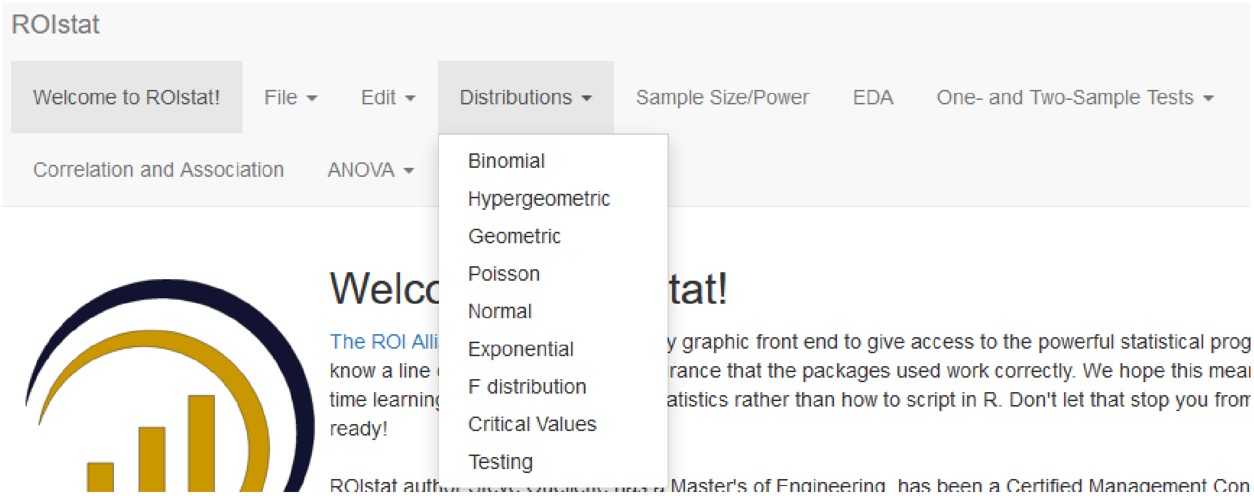


You can select a violin plot or show the 95% confidence interval of the median as a notch by clicking on the check boxes. You can change the width and height by using the sliders.

The gear dropdown will allow you to customize the chart title, x- and y-axis labels and choose a larger font. You can select the format and download the graphic.

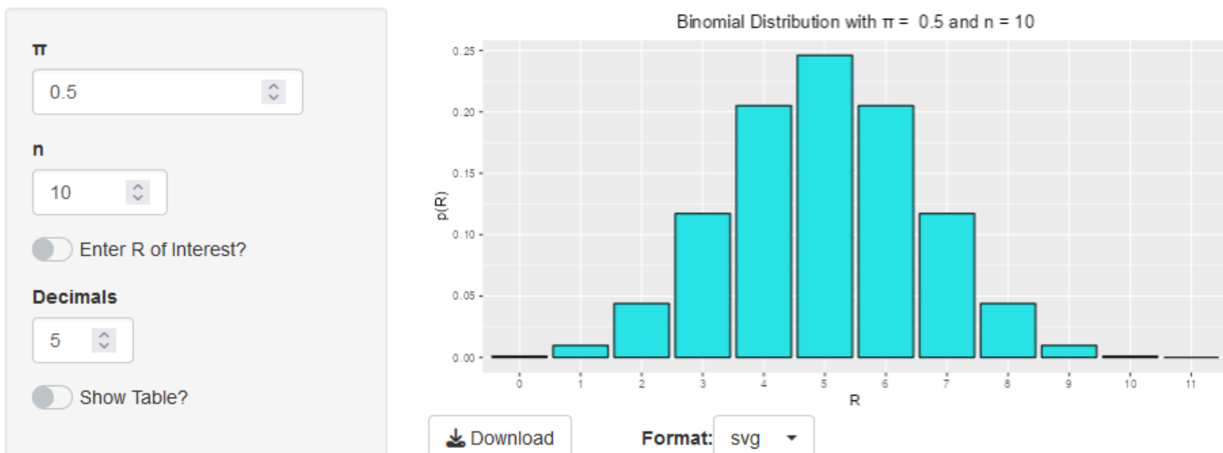
Chapter 4 – Probability Distributions

You can access various probability distributions and tests on the **Distributions** menu item.



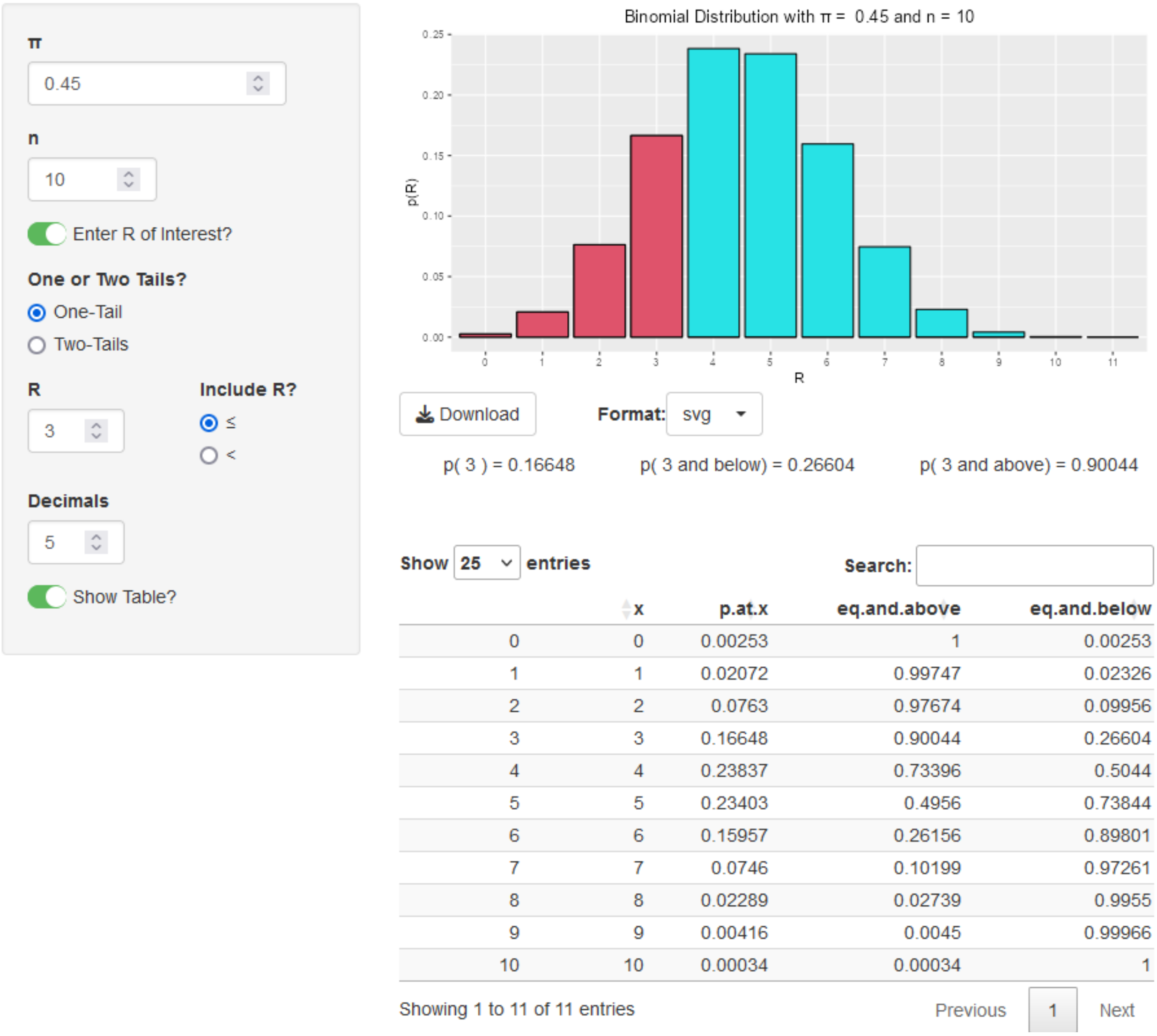
Binomial Distribution

Selecting the binomial distribution shows you this:



You can change the population average π by typing in the box labeled **π** and the sample size by typing in the box labeled **n**. The example in the book had a **π** = 0.45 and an **n** = 10.

If you are interested in a specific point, choose **Enter R of Interest?** and you can select a particular count. You can choose to show the graph with that R and less or just less than the R you chose. The graph updates with the selection and adds the probabilities of R, R and below, and R and above.



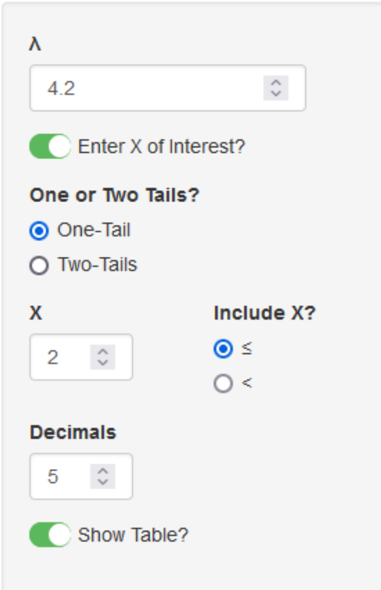
	x	p.at.x	eq.and.above	eq.and.below
0	0	0.00253	1	0.00253
1	1	0.02072	0.99747	0.02326
2	2	0.0763	0.97674	0.09956
3	3	0.16648	0.90044	0.26604
4	4	0.23837	0.73396	0.5044
5	5	0.23403	0.4956	0.73844
6	6	0.15957	0.26156	0.89801
7	7	0.0746	0.10199	0.97261
8	8	0.02289	0.02739	0.9955
9	9	0.00416	0.0045	0.99966
10	10	0.00034	0.00034	1

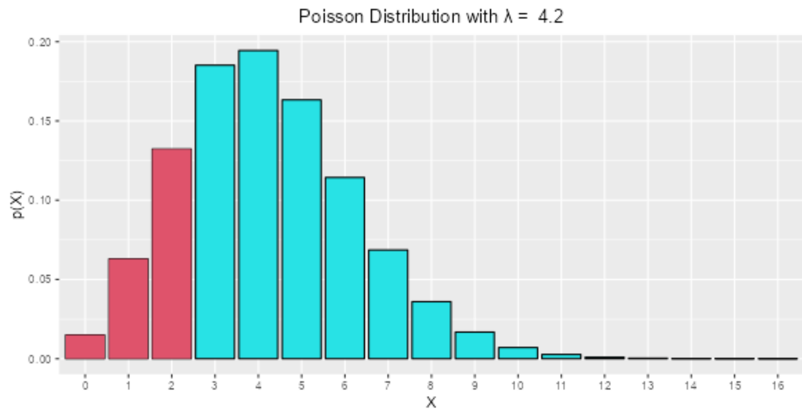
Decimals controls the number of decimals displayed here. Clicking **Show Table?** will print out a table with all the probabilities for each R, R and below, and R and above. You can expand the number of entries on this table to the length you need. You can save the graphic in a variety of formats by selecting the format and clicking the Download button.

Poisson Distribution

The Poisson distribution has similar options as the binomial. You create one by selecting **Poisson** on the **Distributions** dropdown menu item.

You can change **λ**. In the book **λ** was 4.2. You can Enter X of interest? by clicking on the slider switch. In the book we were interested in X = 2. We can display the table by clicking on **Show Table**? You can also control the number of **Decimals.**





Download Format: svg

p(2) = 0.13226 p(2 and below) = 0.21024 p(2 and above) = 0.92202

Show 25 entries Search:

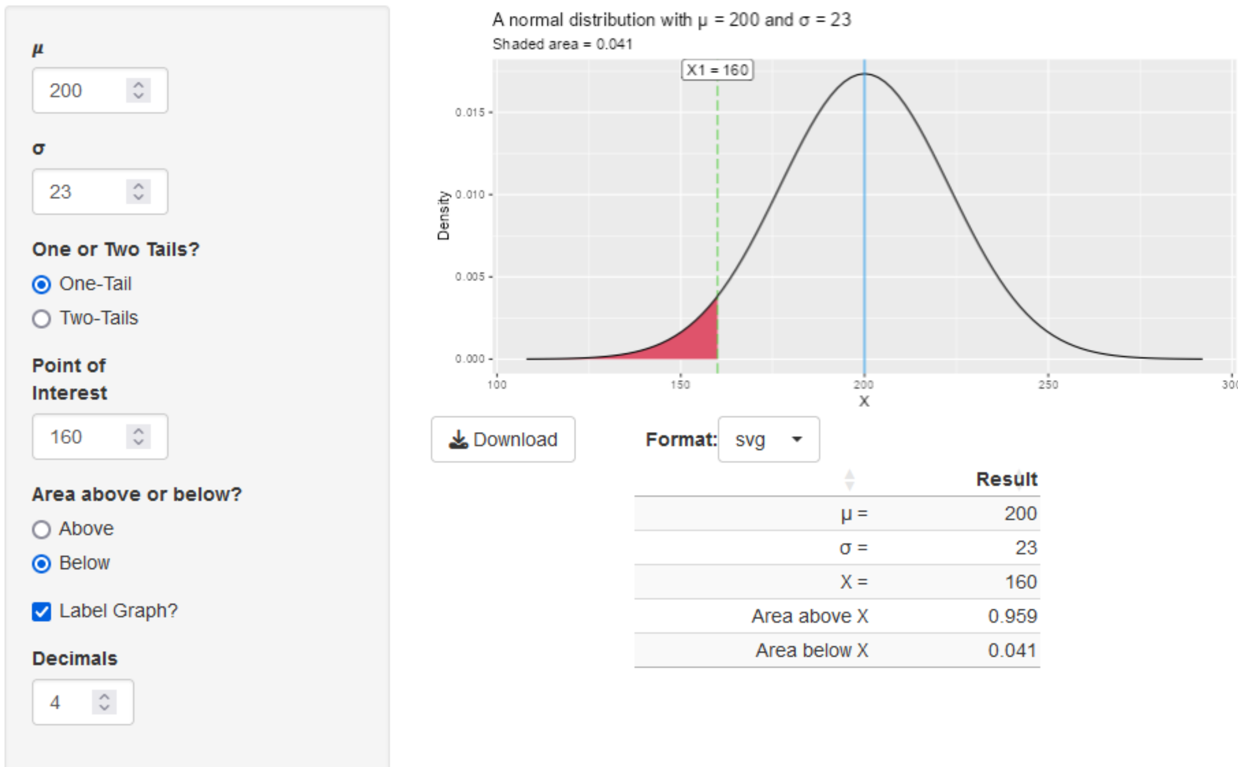
	x	p.at.x	eq.and.above	eq.and.below
0	0	0.015	1	0.015
1	1	0.06298	0.985	0.07798
2	2	0.13226	0.92202	0.21024
3	3	0.18517	0.78976	0.3954
4	4	0.19442	0.6046	0.58983
5	5	0.16332	0.41017	0.75314
6	6	0.11432	0.24686	0.86746
7	7	0.06859	0.13254	0.93606
8	8	0.03601	0.06394	0.97207
9	9	0.01681	0.02793	0.98887
10	10	0.00706	0.01113	0.99593
11	11	0.00269	0.00407	0.99863
12	12	0.00094	0.00137	0.99957
13	13	0.0003	0.00043	0.99987
14	14	0.00009	0.00013	0.99997
15	15	0.00003	0.00003	0.99999
16	16	0.00001	0.00001	1

Showing 1 to 17 of 17 entries Previous 1 Next

Normal Distribution

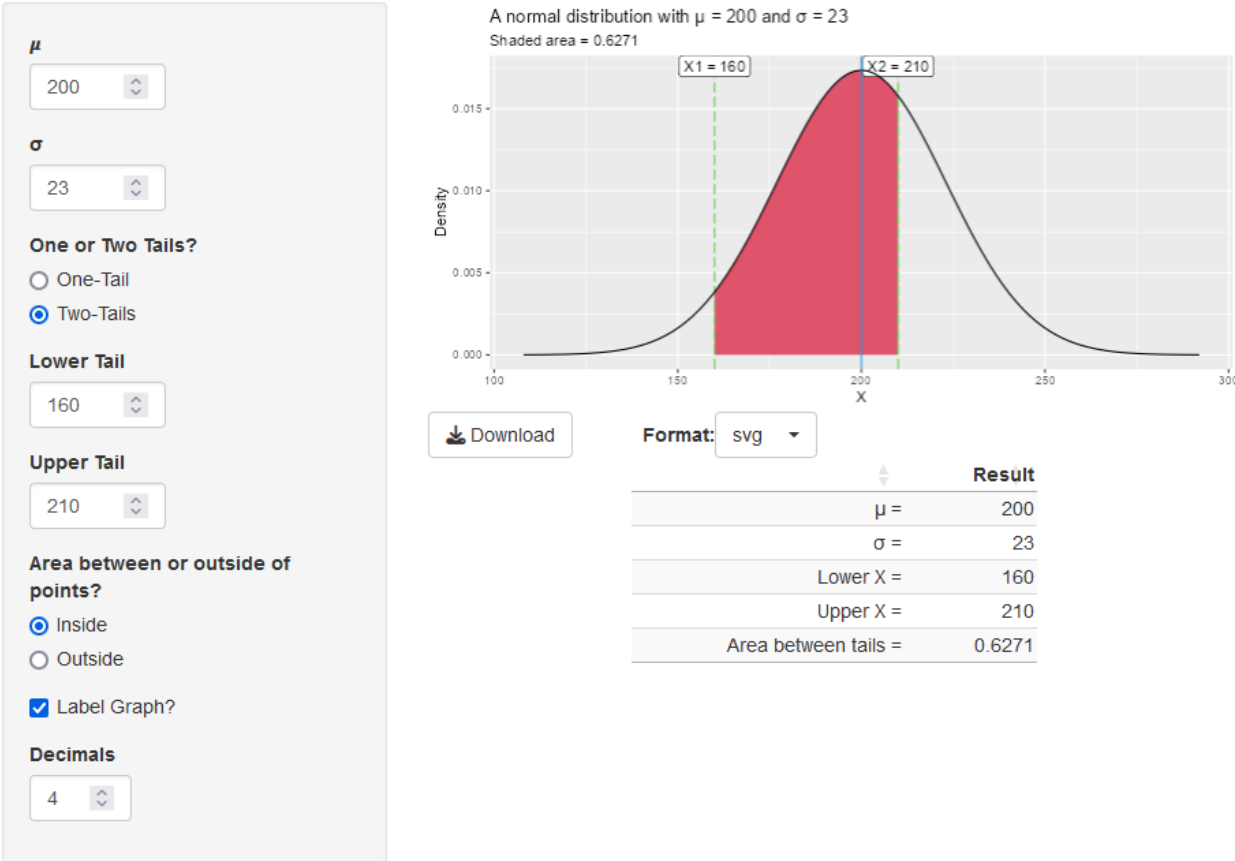
You can make the normal distribution by selecting **Normal** from the **Distributions** dropdown.

In the book we had a distribution with a **μ** = 200 and **σ** = 23 and were interested in the probability below 160.



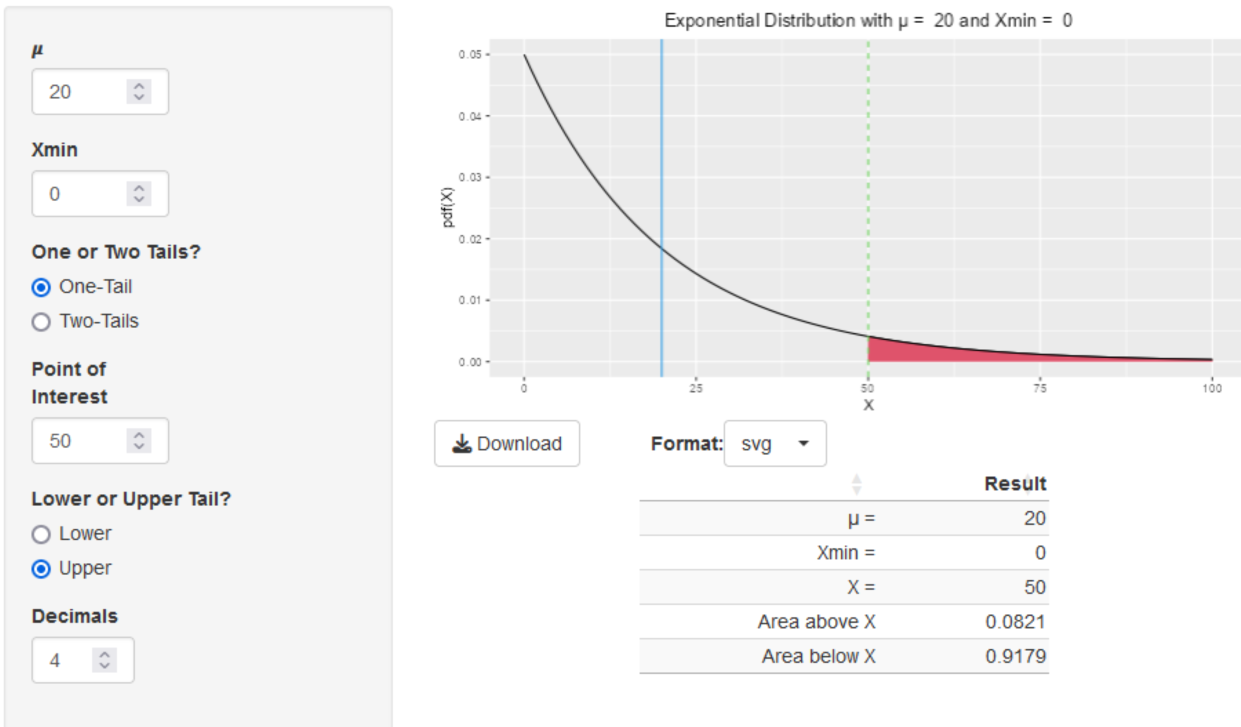
The graph can display the area **Above** or **Below** the point of interest. If the label for the point of interest is in the way, you can unselect the **Label Graph?** check box. **Decimals** controls the number of decimals reported. You can save the graphic in a variety of formats.

If you want to know the probability **Inside** or **Outside** of two points of interest, select **Two-Tails** and enter the two points of interest:



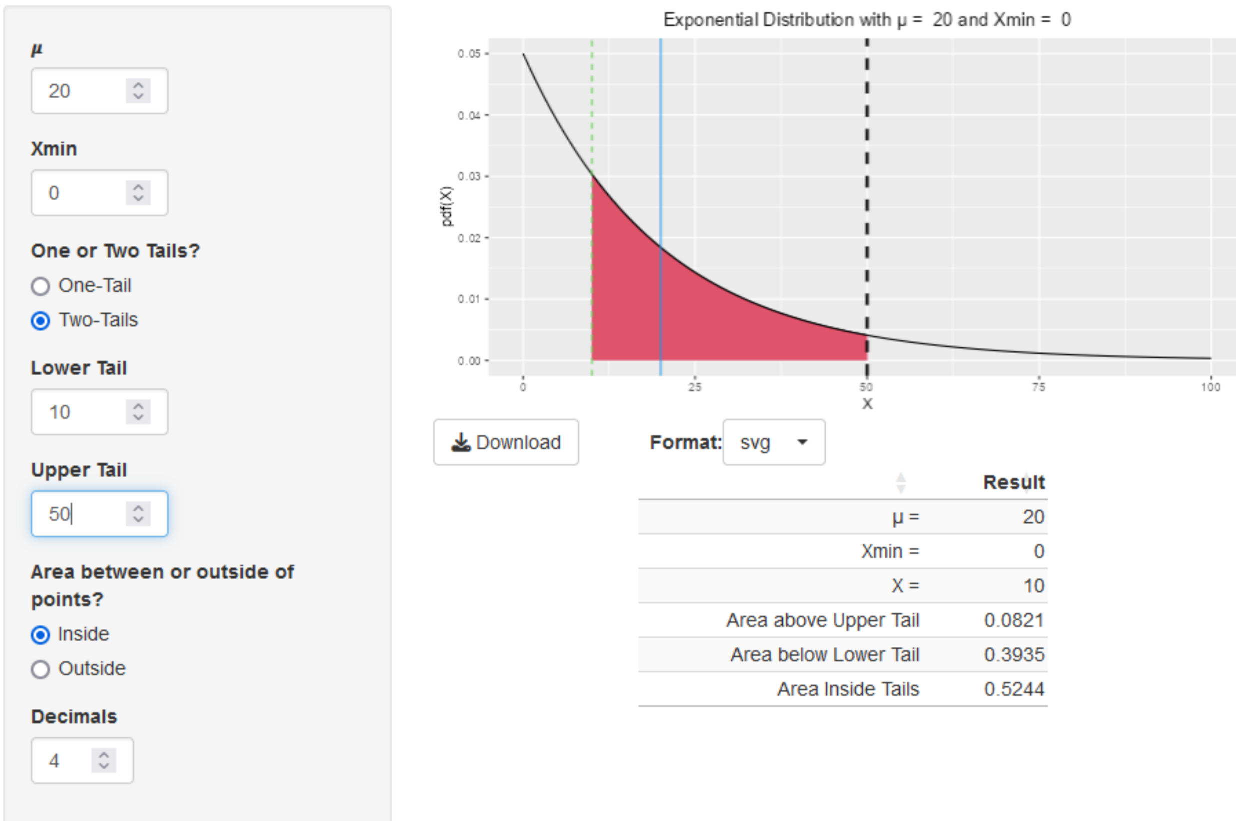
Exponential Distribution

To create an exponential distribution, select **Exponential** from the **Distribution** dropdown menu item. In the book we were interested in the probability for the **Point of Interest** = 50 for an exponential distribution with a **μ** = 20 and an $\boldsymbol{X_{min}}$ = 0.



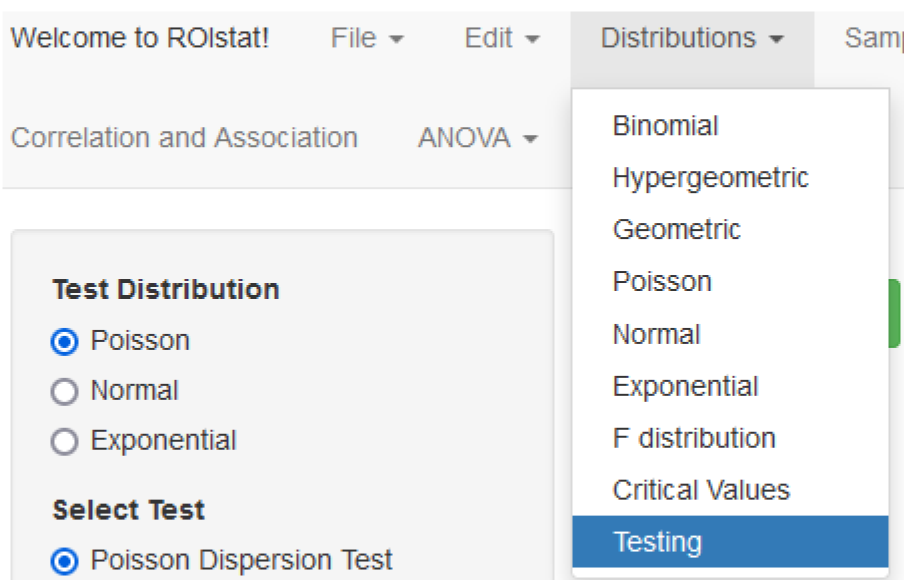
The graph can display the area for the **Lower** or **Upper** tails. You can control the number of **Decimals**.

If you want to know the probability **Inside** or **Outside** of two points of interest, select **Two-Tails** and enter the two points of interest:



Chapter 5 – Distribution Testing

Distribution testing requires that you have data loaded to test. It is located under the **Distribution** dropdown menu.



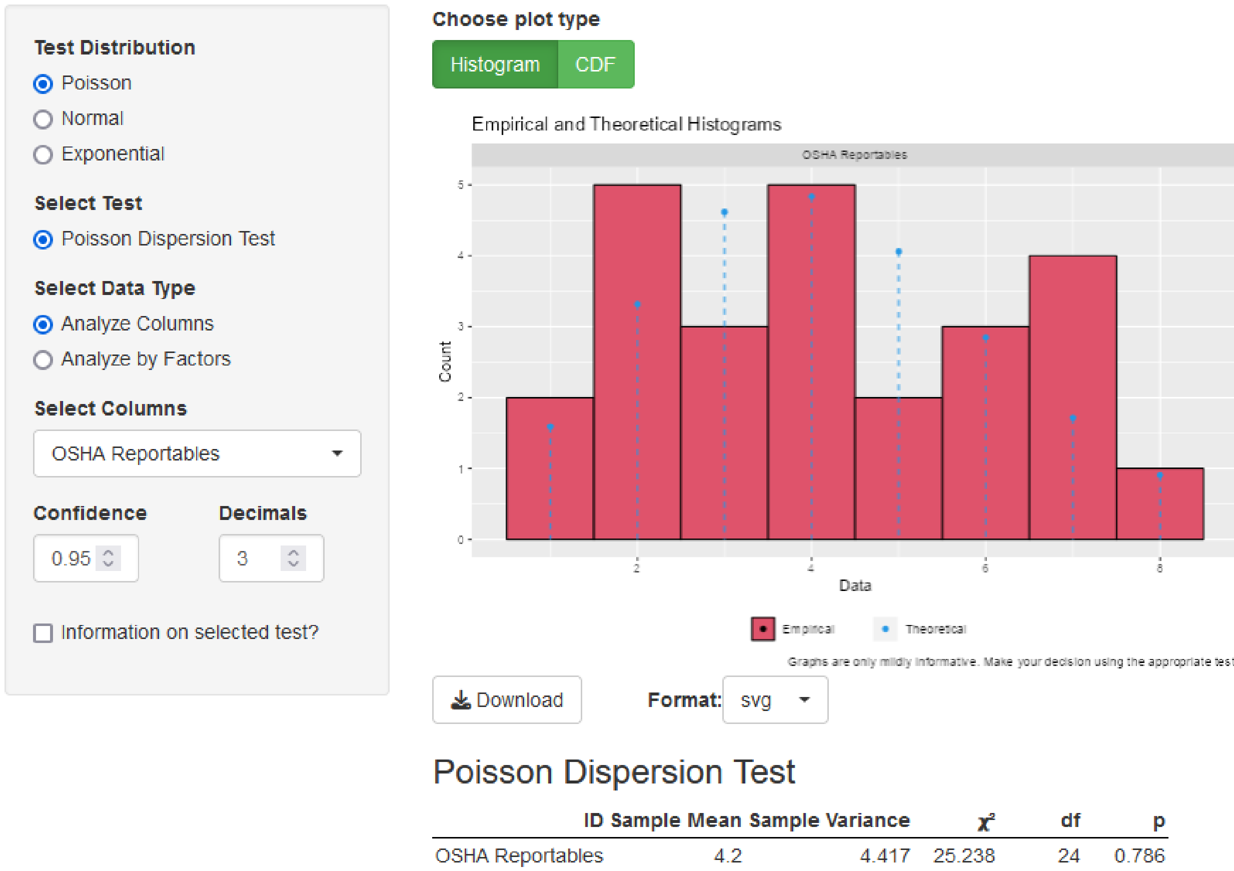
Testing for Poisson Distributions

Here is the data for the Poisson testing example:

OSHA Reportables
6
8
1
7
3
4
4
7
6
7
4
5
5
2
7
2
2
3
1
3
4
6
2
2
4

You can copy and paste this into ROIstat.

Select the Poisson radio button under Test Distribution. You will need to tell the app how the data is configured. In this case, the data is a column, so we Analyze by Columns. Select Columns to get the OSHA data:



ID	Sample Mean	Sample Variance	χ^2	df	p
OSHA Reportables	4.2	4.417	25.238	24	0.786

Confidence lets you choose the confidence of both the test and any confidence intervals that are reported. **Decimals** controls the number of decimals reported.

You can get a pop-up window for more **Information on the selected test**.

There are two types of plots that you can select. For the Poisson these are a **Histogram** displaying the data and the theoretical distribution and the Cumulative Density Function, or **CDF**.

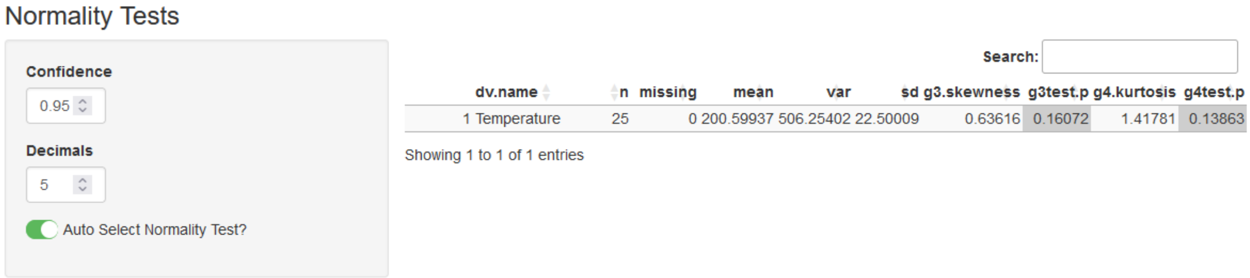
The results of the test are displayed in a table.

You can download the graphic in a number of formats.

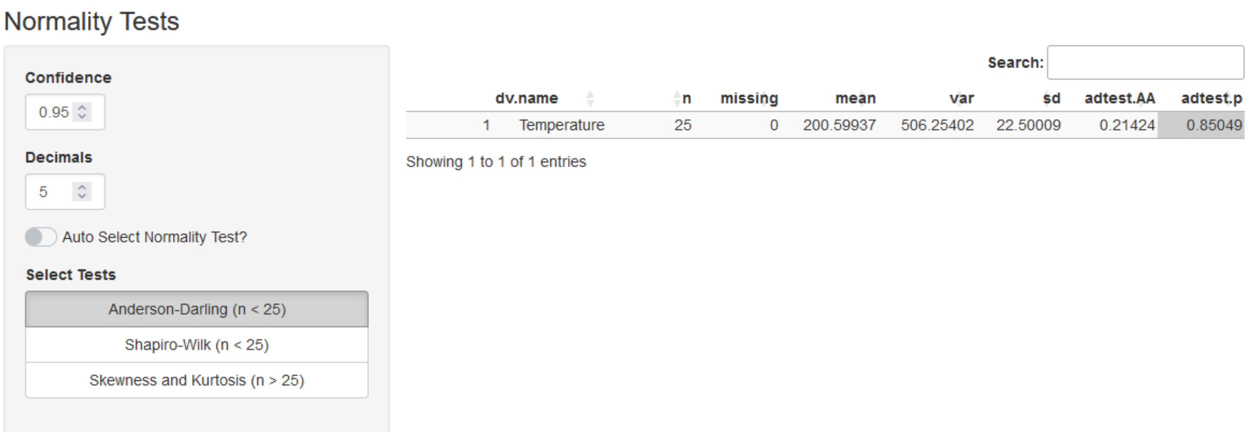
Testing for Normal Distributions

There are a couple of ways to test for normality.

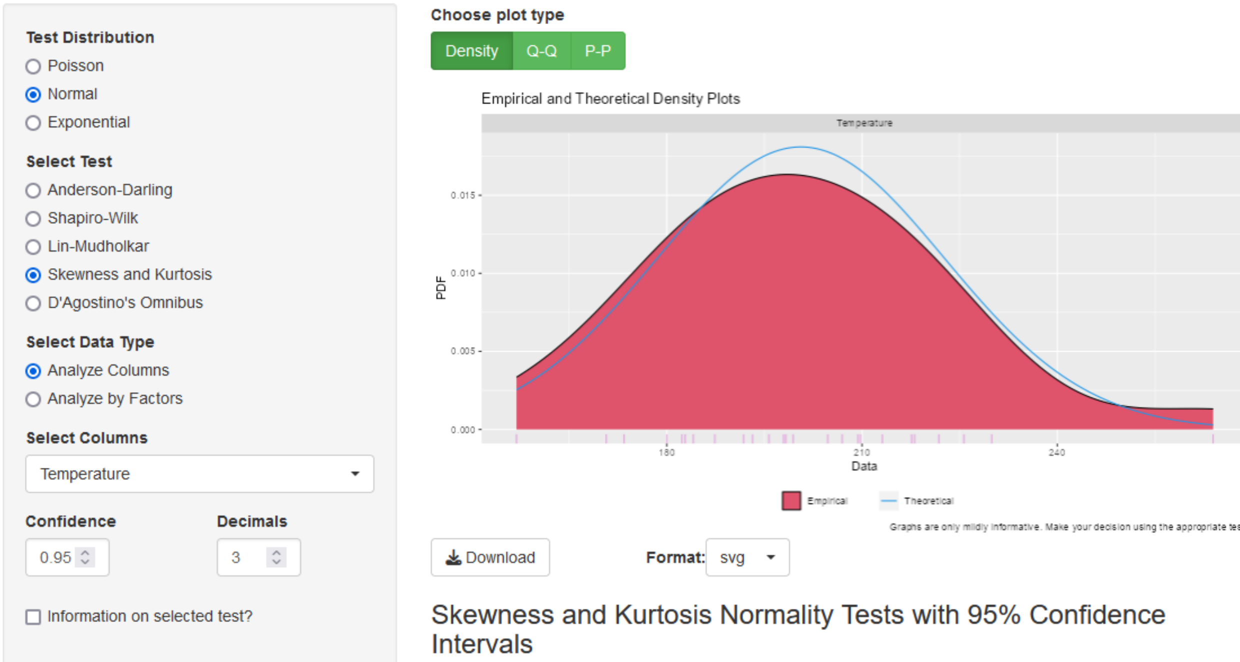
If you are already exploring the data in EDA, you can get them quickly by clicking on the **Normality Test** tab. The example data was **OVEN.CSV**.



You can control the **Confidence** of the test and the number of **Decimals** reported. Here you can have the app automatically select the best normality tests depending on the sample size. If you wish to manually control what tests are reported, turn off the **Auto Select Normality Test?** slider. You will then see buttons for the three tests available here.



If you want more options for normality testing, click on **Distributions** and then **Testing**, then select **Normal** under **Test Distribution**. You will see a list of more tests, and each test will give you more information than the ones available under **EDA**. Select how the data is configured and whatever data sets you want to test. The oven temperature data is in a column.



Skewness and Kurtosis Normality Tests with 95% Confidence Intervals

ID	n	g_3(low)	g_3	g_3(high)	p(Skew)	g_4(low)	g_4	g_4(high)	p(Kurt)
Temperature	25	-0.273	0.636	1.545	0.161	-0.35	1.418	3.185	0.139

Confidence lets you choose the confidence of both the test and any confidence intervals that are reported. **Decimals** controls the number of decimals reported.

You can get a pop-up window for more **Information on the selected test**.

There are three types of plots that you can select. For the normal these are a **Density** plot displaying the data and the theoretical distribution, the quantile-quantile (**Q-Q**) and probability-probability (**P-P**) plots, showing the data as points and the theoretical distribution as a line. If the data is perfectly normal, you would expect to see all the dots on the line for these two plots.

The results of the test are displayed in a table.

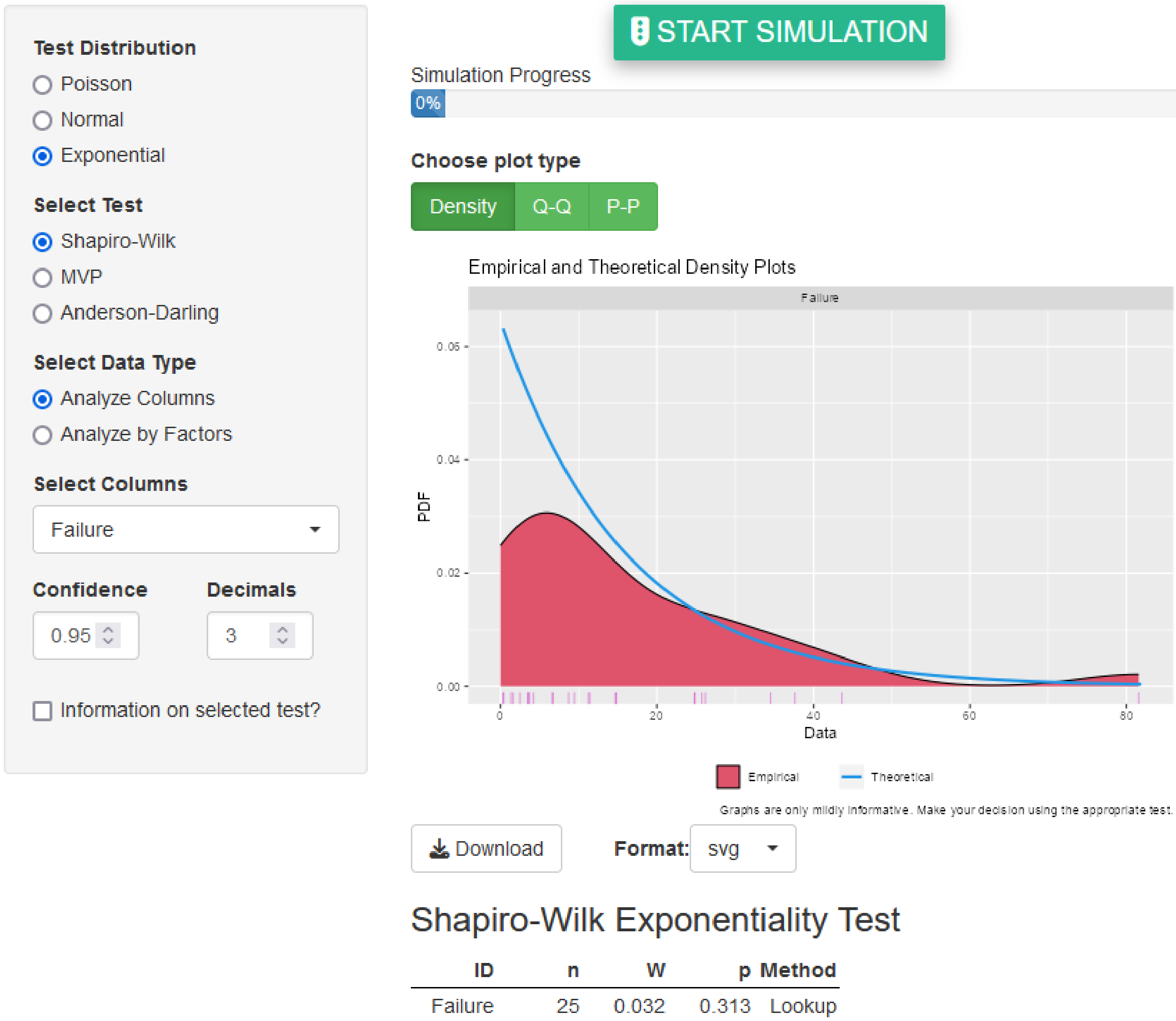
You can download the graphic in a number of formats.

Testing for Exponential Distributions

The exponential tests are located under the **Distributions** dropdown in **Testing**. The example data was TTF1.CSV.

Select the **Test Distribution** to be **Exponential**. You will see the available tests under **Select Test**.

The **Shapiro-Wilk** and **MVP** tests are Monte Carlo tests, so they will both have a **Start Simulation** button when you have the data set up and are ready to run the tests. The Time to Failure data is in a column.



Confidence lets you choose the confidence of both the test and any confidence intervals that are reported. **Decimals** controls the number of decimals reported.

You can get a pop-up window for more **Information on the selected test**.

There are three types of plots that you can select. For the exponential these are a **Density** plot displaying the data and the theoretical distribution, the quantile-quantile (**Q-Q**) and probability-probability (**P-P**) plots, showing the data as points and the theoretical distribution as a line. If the data is perfectly exponential, you would expect to see all the dots on the line for these two plots.

The results of the test are displayed in a table.

You can download the graphic in a number of formats.

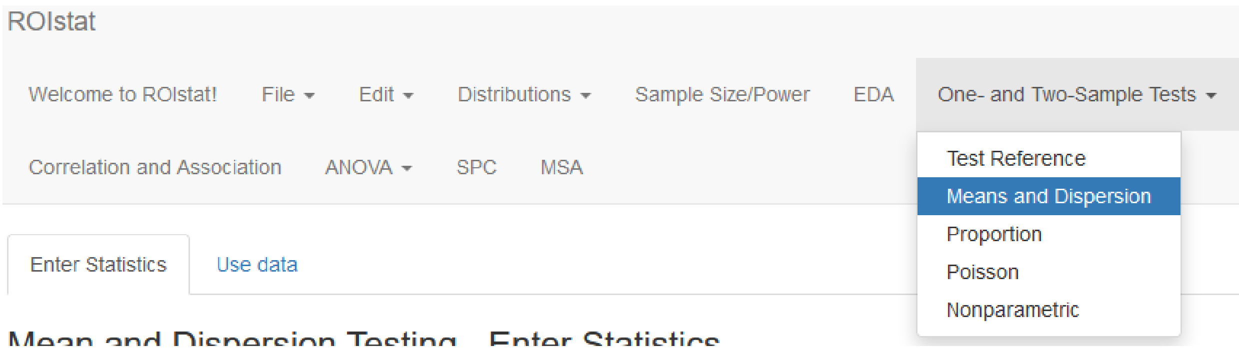
Chapter 6 – Estimation

Central Limit Theorem- Getting a z-Score and Probability for the RSD

The Central Limit Theorem is built into hypothesis testing, so you can get quick results for some of the discussion by using one-sample tests to "trick" the app into doing the work.

In the example we know that the data has an average of 9.237, a standard deviation of 6.552 and a sample size of 30. We are testing to see if the sample could have come from a population with μ_0 = 10.

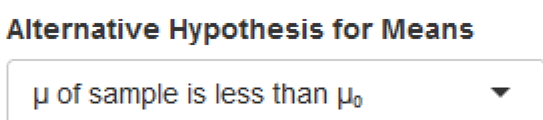
Select **One- and Two-Sample Tests** from the menu dropdown and then **Means and Dispersion**.



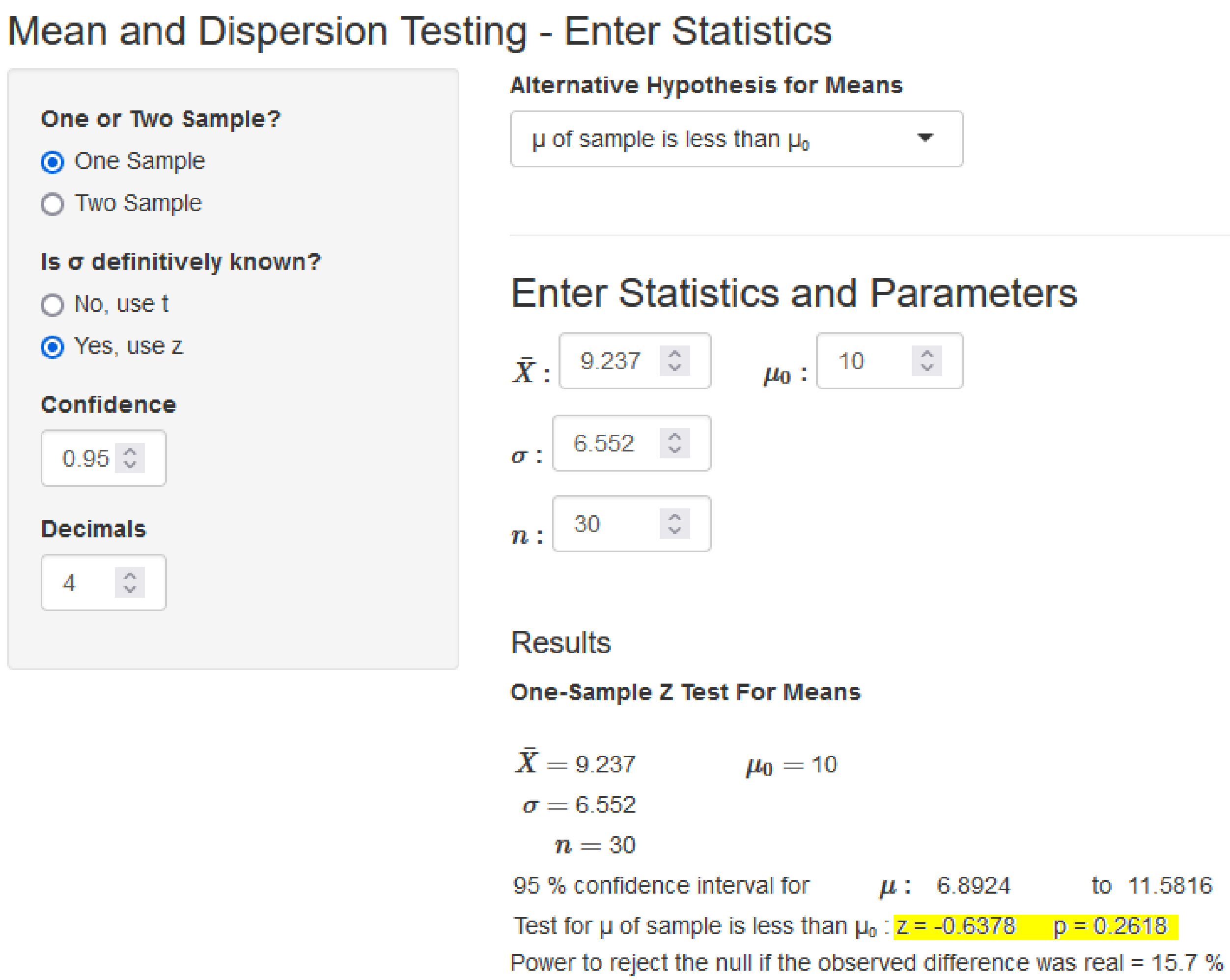
You will **Enter Statistics**, so select that tab.

All we need from the app is the z-score and probability of the RSD so we can choose **One Sample**. Since we used a normal distribution, select **Is σ definitively known?** as **Yes, use z**.

Since we are asking if the sample is lower than the population, select



Enter the sample statistics and the population average.



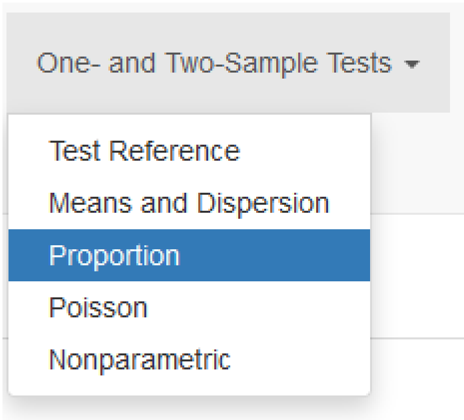
You can find the *z*-score and the p-value at the highlight, with a little rounding difference.

Confidence Intervals

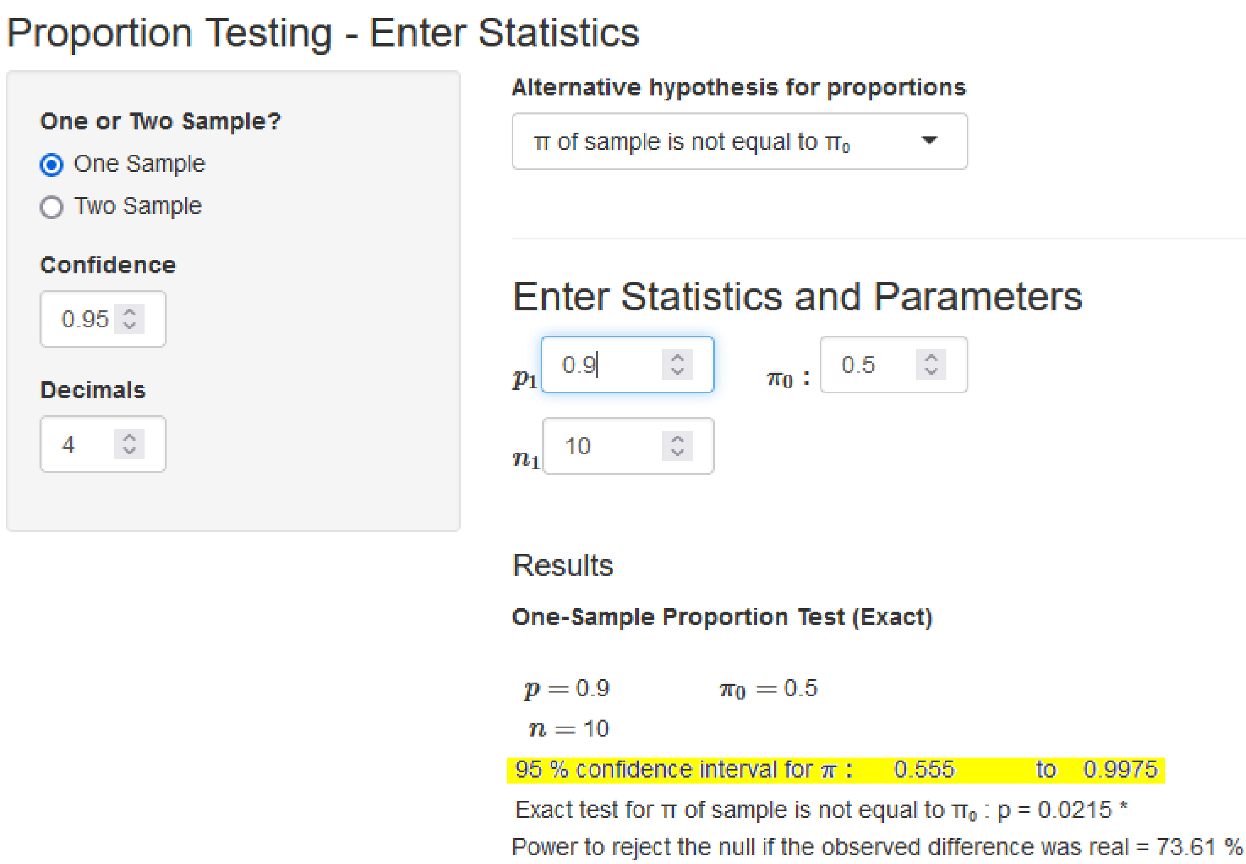
Most tests will give you confidence intervals, so we can again use this to our advantage.

Binomial Confidence Intervals

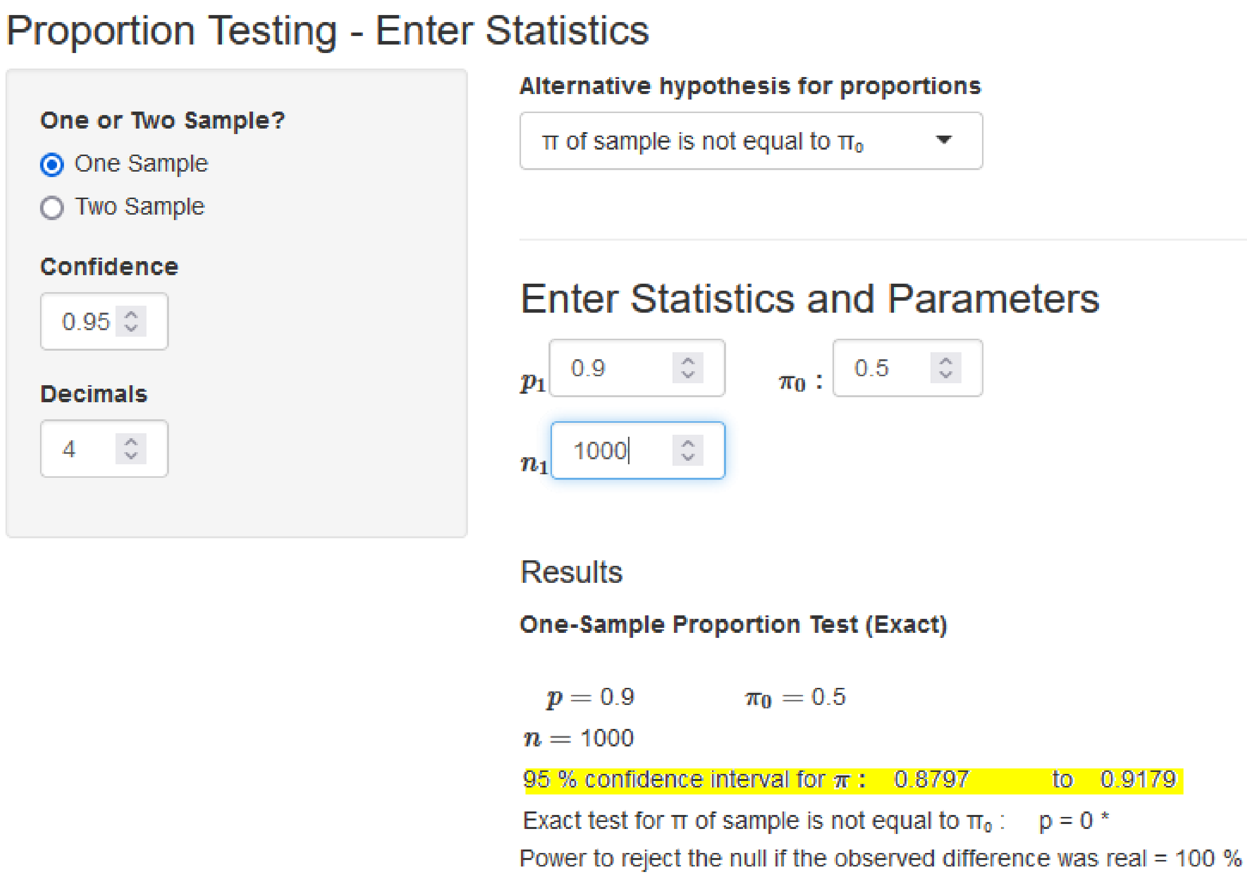
The example with customer satisfaction is a binomial distribution, so we can use the binomial proportiono test to get confidence intervals. This is under **One- and Two-Sample Tests**, **Proportion**.



The first scenario is a point estimate of 90% based on 10 interviews. Since we just want the confidence interval, the null population parameter doesn't matter. Just enter the statistic and sample size, along with the desired confidence level, to get the confidence interval.

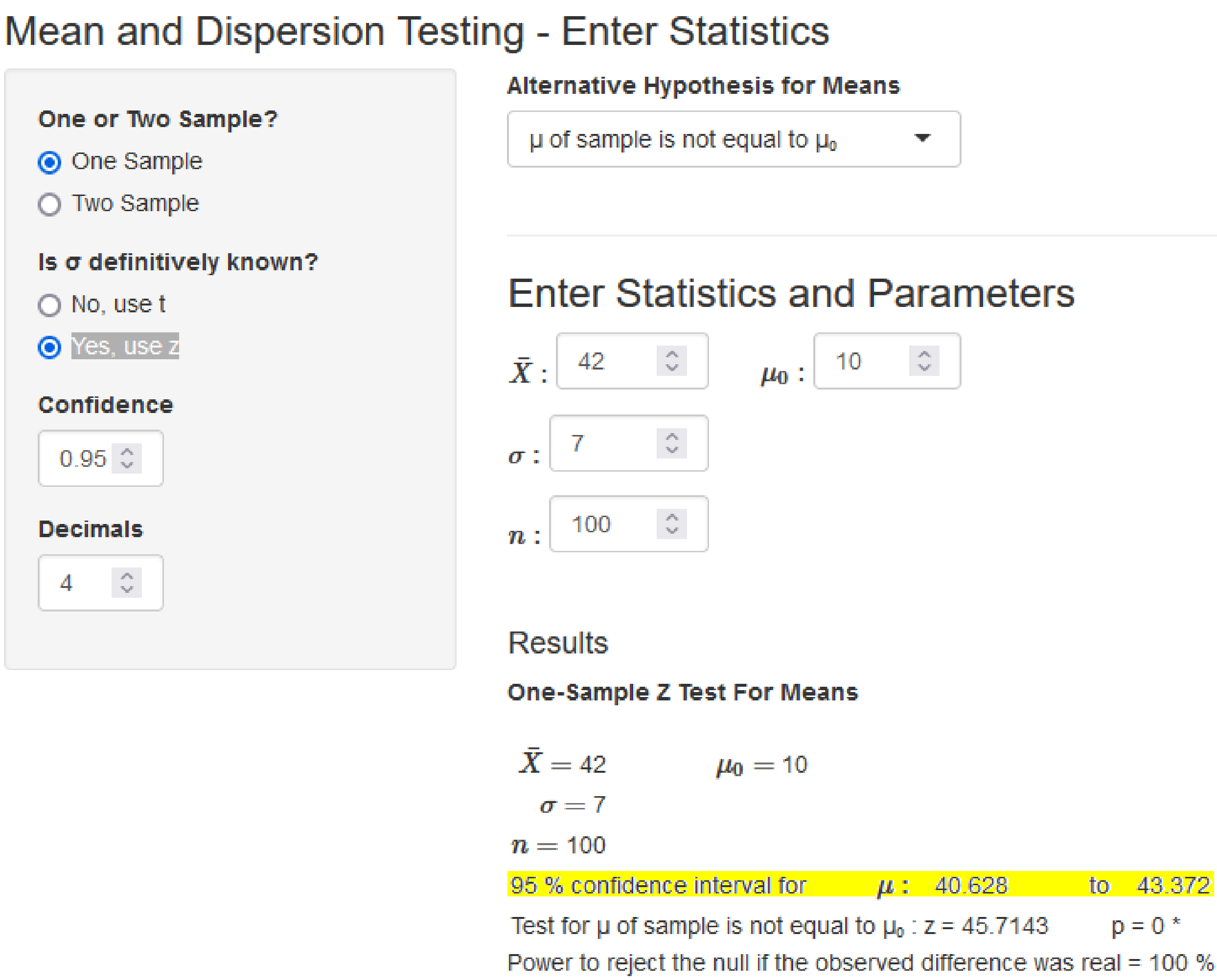


The second scenario is also 90% but based on a sample size of 1,000:



Normal Confidence Intervals

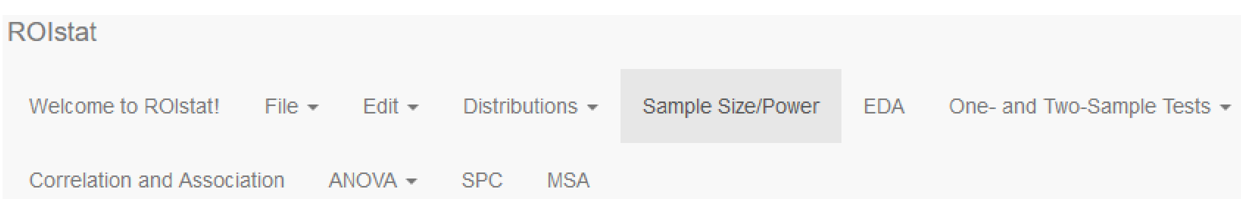
We can use the same trick as above to get confidence intervals for a normal distribution. In the example, we are looking for the confidence interval for a normal distribution with an average of 42, a standard deviation of 7 from a sample size of 100. In order to get the normal distribution confidence intervals, you need to select **Yes, use z** for **Is σ definitively known?** Since we only want the confidence interval, it doesn't matter what you put in for the null parameter.



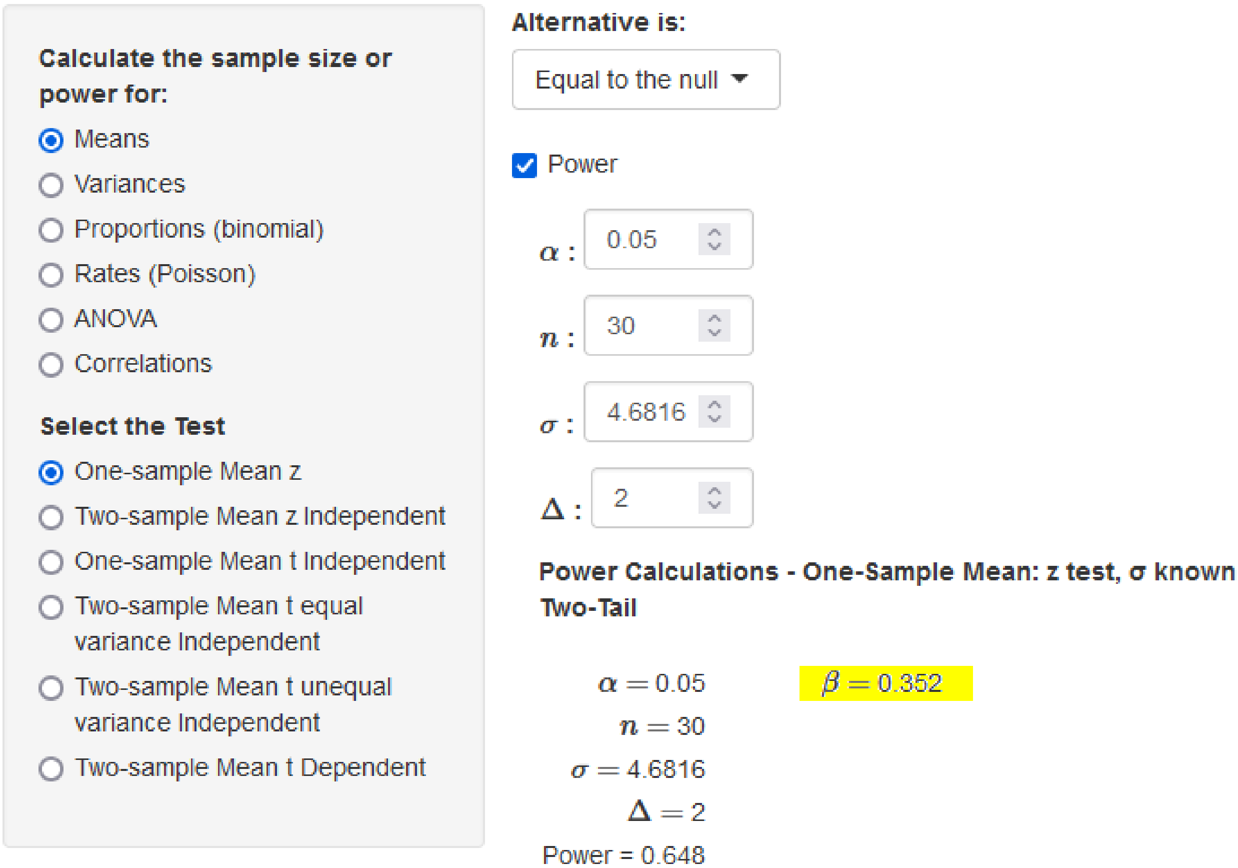
Chapter 8 – Sample Size

Calculating Power

In the ZapCareer example to calculate power, the effect size is 2, α = 0.05, σ = 4.6816, and n = 30. Select Sample Size/Power from the menu.

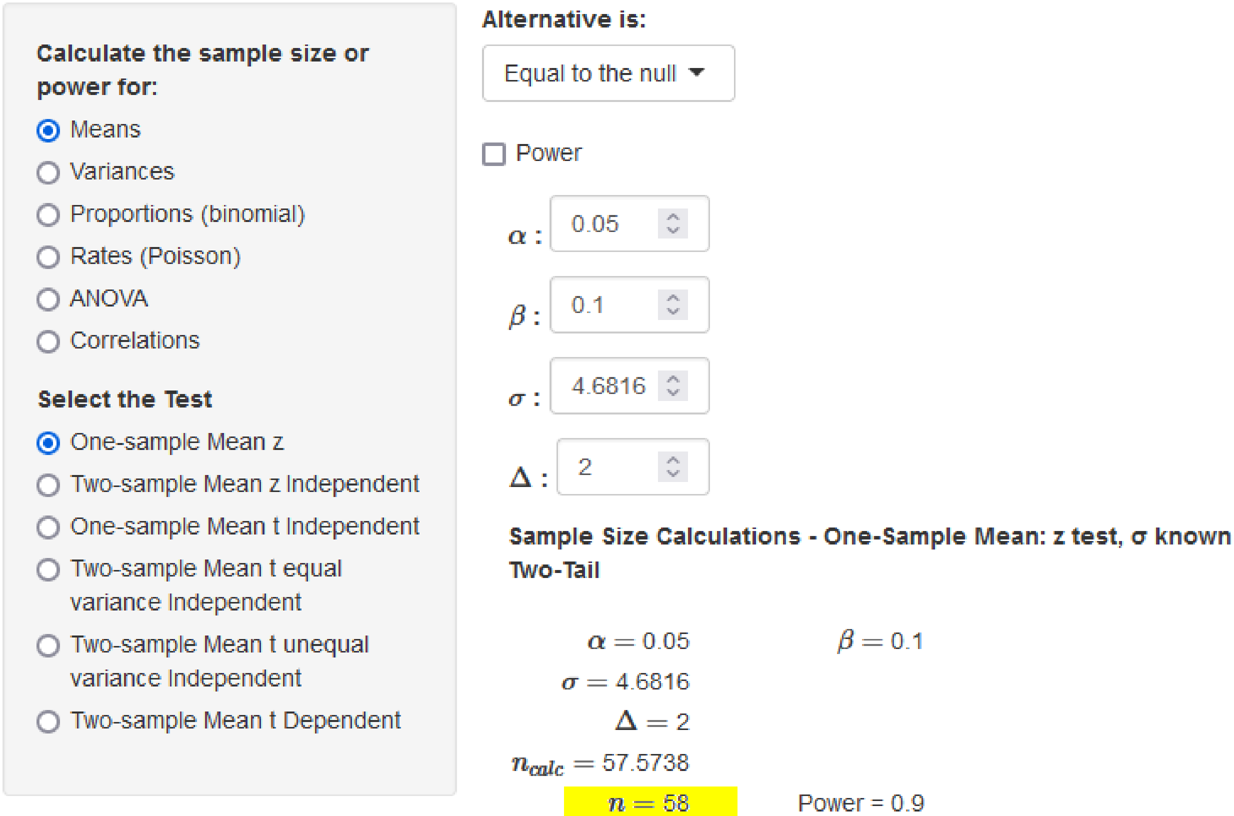


This is a problem about the averages, so select **Calculate the sample size or power for: Means**. The example uses the normal distribution, so **Select the Test: One-sample Mean z**. Select the **Power** checkbox and enter the statistics.



Calculating Sample Size

To calculate the sample size, we set it up the same way as above, uncheck the **Power** checkbox, and enter the required **β** = 0.1.

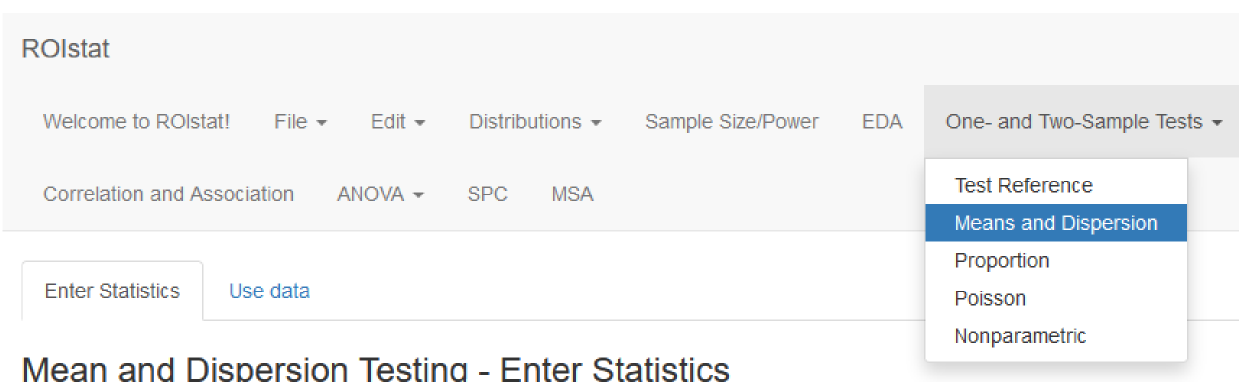


Chapter 10 – One-Sample Hypothesis Tests

One-Sample *z*-Test for Known σ

The data in the example is **TTF ZapCareer.txt**. We have already reviewed how to generate a run chart and kernel density plot above.

Once you have the data loaded, go to the One- and Two-Sample Tests dropdown menu and select Means and Dispersion:



Tell the app you are using data by clicking on the **Use data** tab.

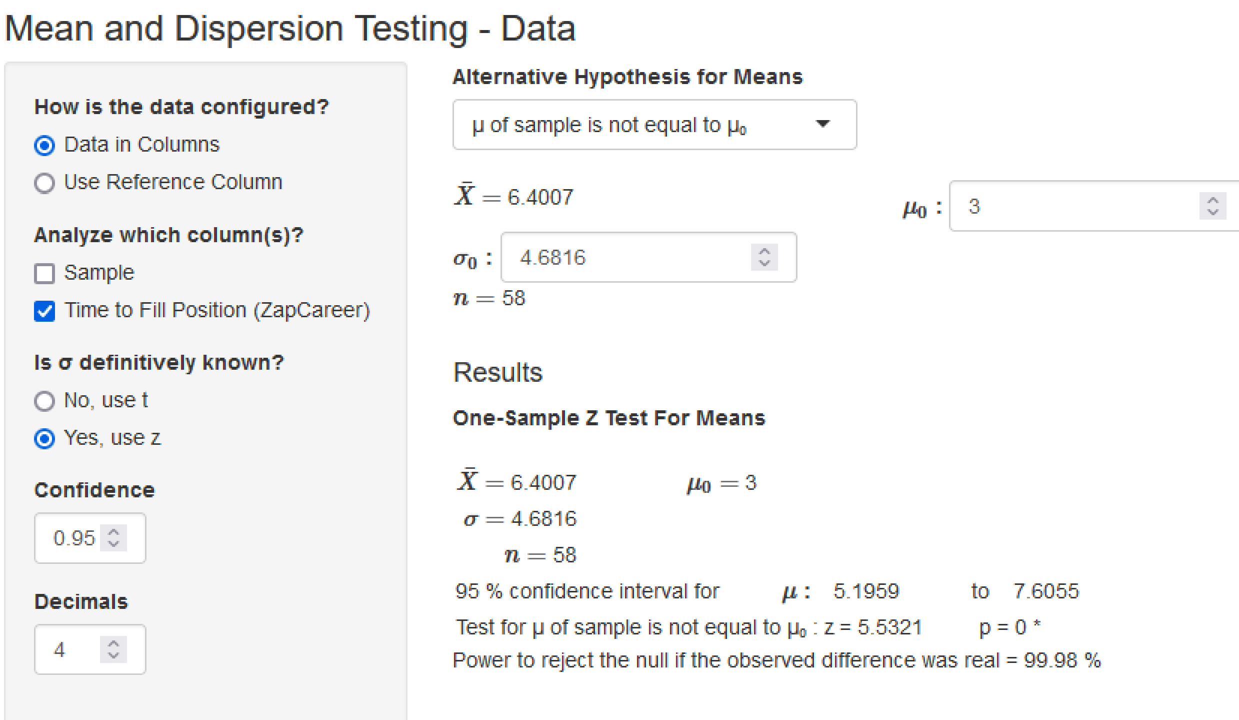
Now you need to tell the app that the **Data is in Columns** under **How is the data configured?**

Select **Time to Fill Position (ZapCareer)** under **Analyze which column(s)?**

Since you only selected one column, ROIstat knows you are performing a one-sample test. We are assuming that the standard deviation is known, so select **Yes, use z** under **Analyze which column(s)?**

The statistics are automatically calculated for the sample, though you can override the calculated standard deviation. Since we believe we know that the standard deviation is 4.6816, enter that for $\boldsymbol{\sigma_0}$.

We are testing against a population average of 8.8428, so enter that as **μ0**. Select an α = 0.05 by choosing a **Confidence** of 0.95. Select the number of desired **Decimal** places. It is a non-directional test, so make sure the **Alternative Hypothesis for Means** is **μ of sample is not equal to** $\boldsymbol{\mu_0}$.



One-Sample *t*-test for Unknown σ

Using the same data, just select **No, use t** under **Is σ definitively known?** You may have to re-enter the null hypothesis mean.

Mean and Dispersion Testing - Data

How is the data configured?

- (•) Data in Columns
- ( ) Use Reference Column

Analyze which column(s)?

- [ ] Sample
- [x] Time to Fill Position (ZapCareer)

Is σ definitively known?

- (•) No, use t
- ( ) Yes, use z

Confidence

0.95

Decimals

4

Alternative Hypothesis for Means

μ of sample is not equal to μ_0

- [ ] One-sample test for variance?

$\bar{X} = 6.4007$

μ_0 : 8.8428

$s = 3.8124$

$n = 58$

Results

One-Sample t Test For Means

$\bar{X} = 6.4007$ $\mu_0 = 8.8428$

$s = 3.8124$

$n = 58$

95 % confidence interval for μ : 5.3983 to 7.4031

σ : 3.2231 to 4.6676

Test for μ of sample is not equal to μ_0 : t = -4.8784 df = 57 p = 0 *

Power to reject the null if the observed difference was real = 99.77 %

One-Sample χ^2 Test for Variance

This is still **TTF ZapCareer.txt**, so it is set up as above, but you click the **One-sample test for variance?** checkbox. You will need to enter 4.6816 for the null $\boldsymbol{\sigma_0}$. It is a non-directional test, so select the **Alternative Hypothesis for Means** is **σ of sample is not equal to $\boldsymbol{\sigma_0}$**. Note that you will not see the checkbox if you have the *z*-test selected, since you would only use the *z*-test if you already know the true variance.

Mean and Dispersion Testing - Data

How is the data configured?

- (•) Data in Columns
- ( ) Use Reference Column

Analyze which column(s)?

- [ ] Sample
- [x] Time to Fill Position (ZapCareer)

Is σ definitively known?

- (•) No, use t
- ( ) Yes, use z

Confidence

0.95

Decimals

4

Alternative Hypothesis for Means

σ of sample is not equal to σ_0

- [x] One-sample test for variance?

$s = 3.8124$

σ_0 : 4.6816

$n = 58$

Results

One-Sample Chi-Square Test For Variance

$s = 3.8125$ $\sigma_0 = 4.6816$

$n = 58$

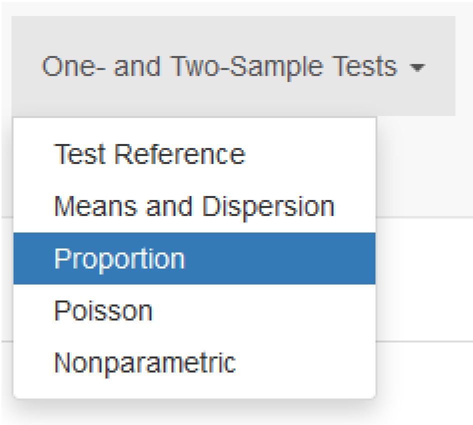
95 % confidence interval for σ : 3.2231 to 4.6676

Test for σ of sample is not equal to σ_0 : $\chi^2 = 37.8002$ df = 57 p = 0.0468 *

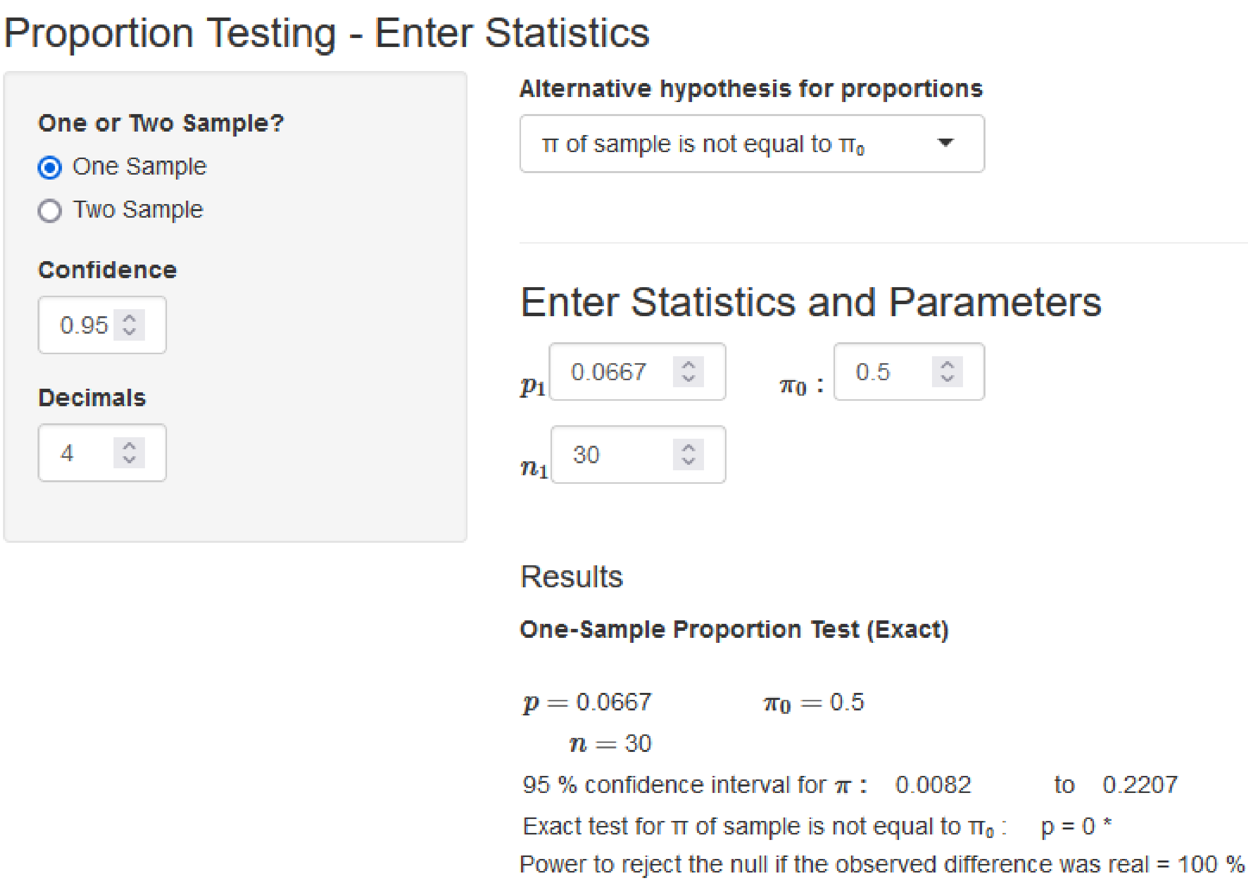
Power to reject the null if the observed difference was real = 53.76 %

One-Sample Proportion Test

Choose **Proportion** on the **One- and Two-Sample Tests** menu dropdown.

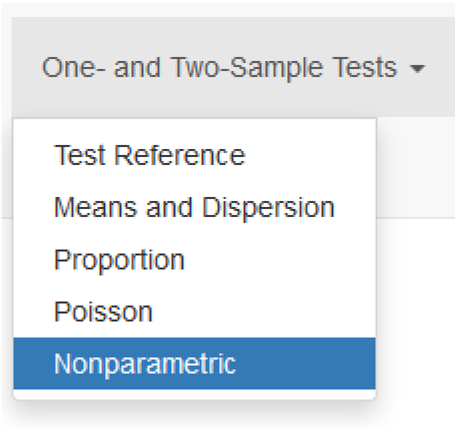


The example in the book just uses statistics, so select the **Enter Statistics** tab. This is a **One Sample** test. Enter **p** = 0.0667, **n** = 30, **π_0** = 0.5 with an α = 0.05 indicated by **Confidence** = 0.95. This is a non-directional test, so make sure that the **Alternative hypothesis for proportions** is **π of samples is not equal to π_0**.

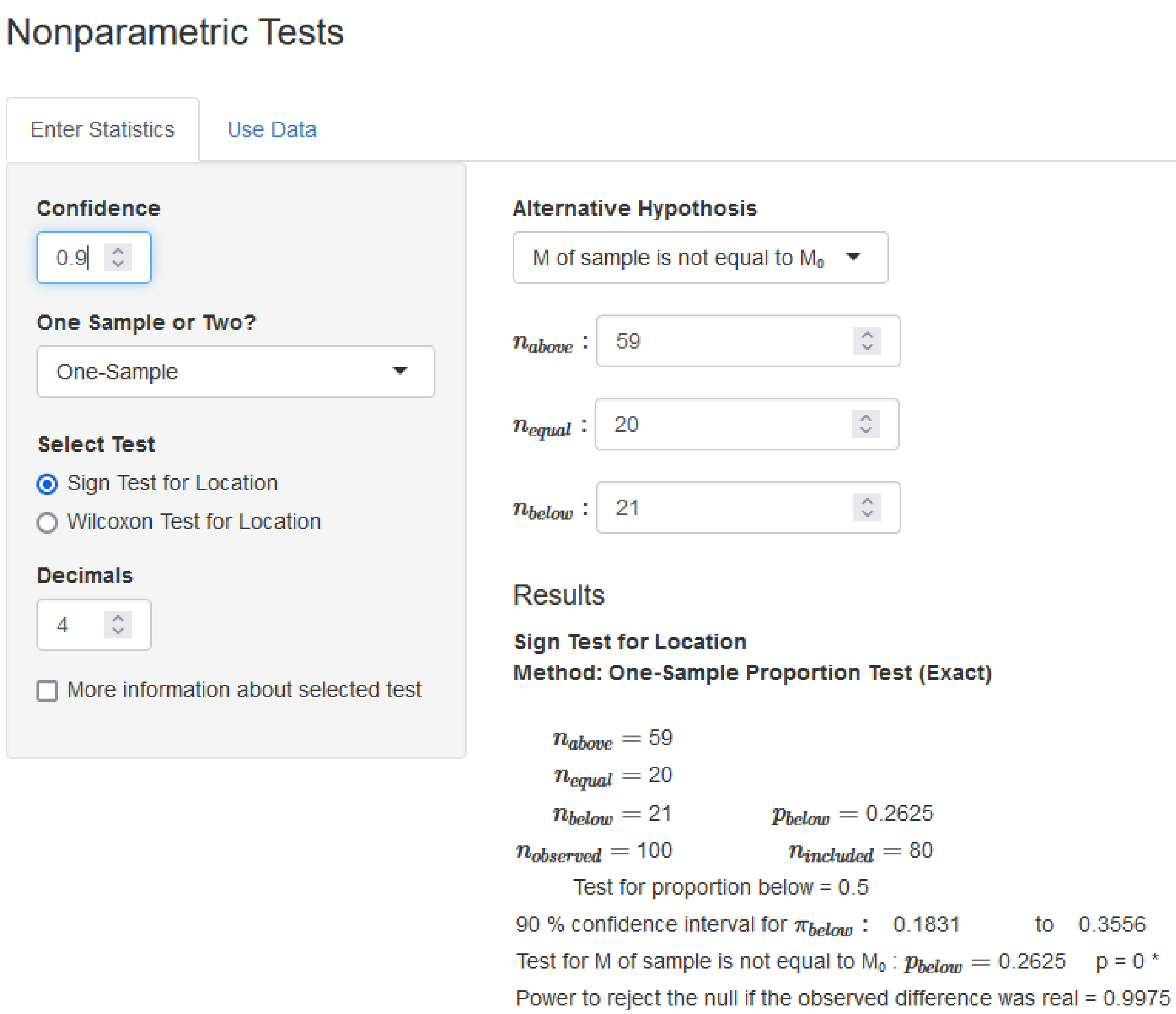


One-Sample Sign Test for Location

This test is a nonparametric test, which just means that there are few assumptions. You can find it under **One- and Two-Sample Tests** then select **Nonparametric Tests**.

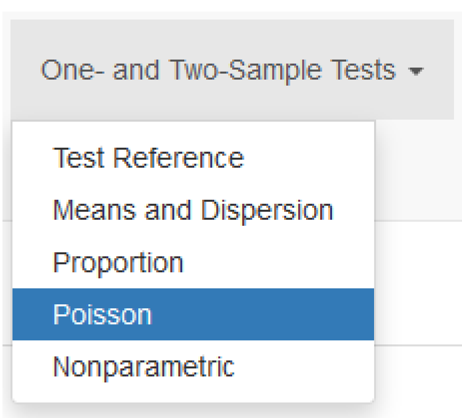


The example in the book uses counts, so make sure the **Enter Statistics** tab is selected and then you can just enter the counts and the null hypothesis directly into the boxes. Choose the **Sign Test for Location** under **Select Test**. The problem calls for an $\alpha = 0.1$, so enter a **Confidence** of 0.9. You can get **More information about the selected test** by checking the box. This is a non-directional test, so make sure the **Alternative Hypothesis** is **M of sample is not equal to M_0**.

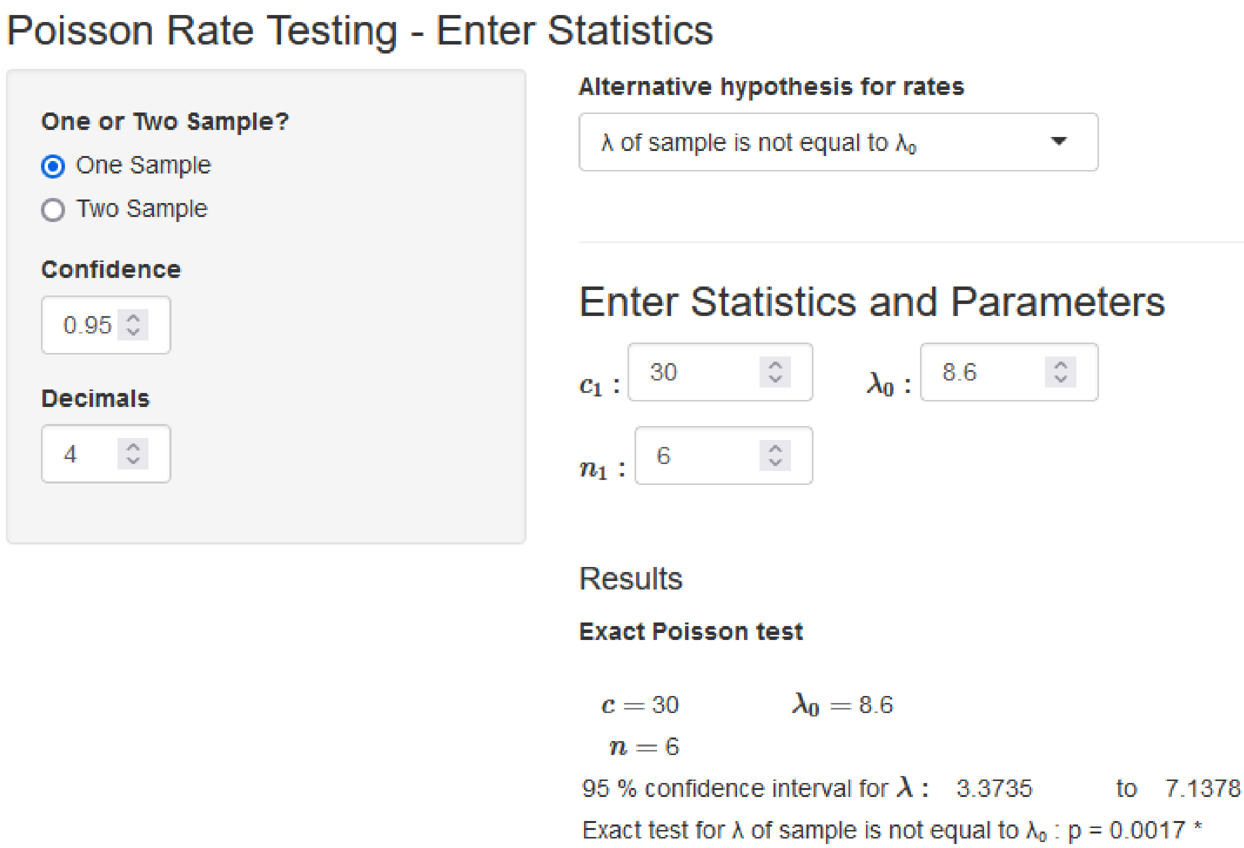


One-Sample Exact Poisson Test

Choose **Poisson** under the **One- and Two-Sample Tests** menu dropdown.



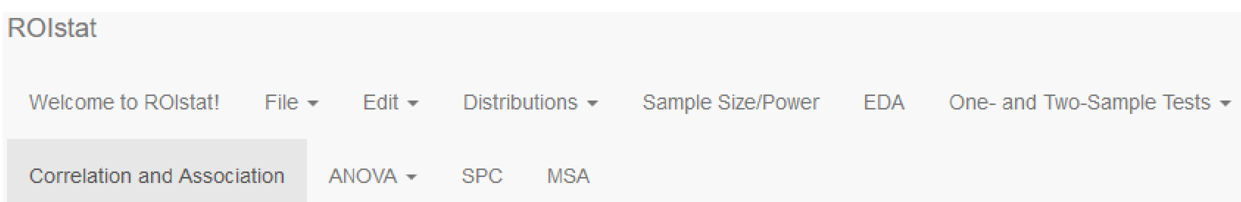
This is a **One Sample** test. You can select **Confidence** and **Decimals**. The example in the book used counts, so select the **Enter Statistics** tab and enter the counts and null hypothesis into the boxes.



Chapter 11 – Correlation, Regression, and Association

Calculating r and One-Sample Test for Correlation, ρ = 0

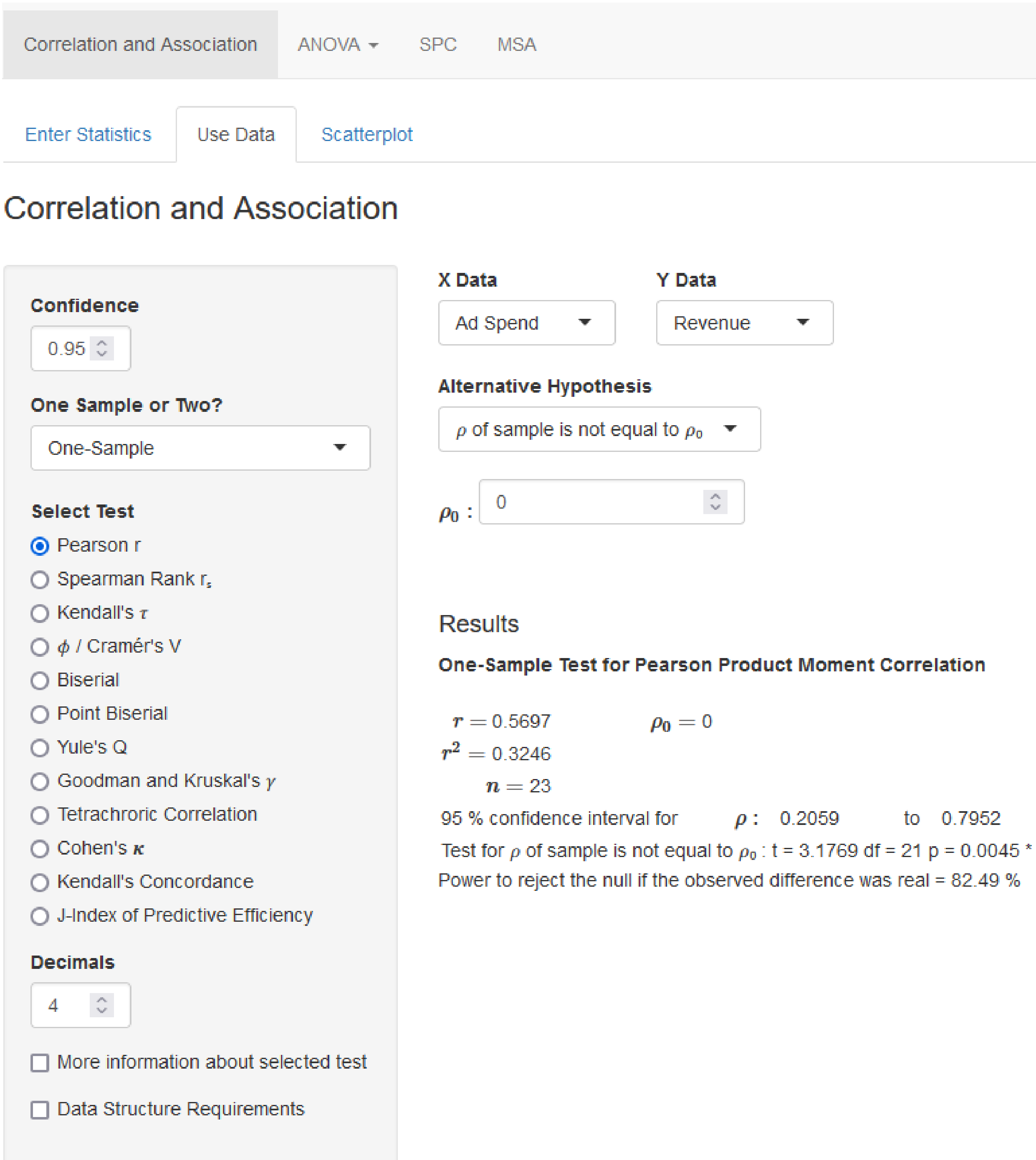
The example uses the data file **FACESPACEADS.CSV**. After that is loaded, click on the **Correlation and Association** menu item.



Select the **Use Data** tab. This is a **One-Sample** test. Choose **Pearson r** under **Select Test**. You can adjust the **Confidence** and **Decimals** and get **More information about the selected test**.

Since different measures of association have different requirements for how you set up your data, there is also a checkbox to learn about the **Data Structure Requirements** for the selected test.

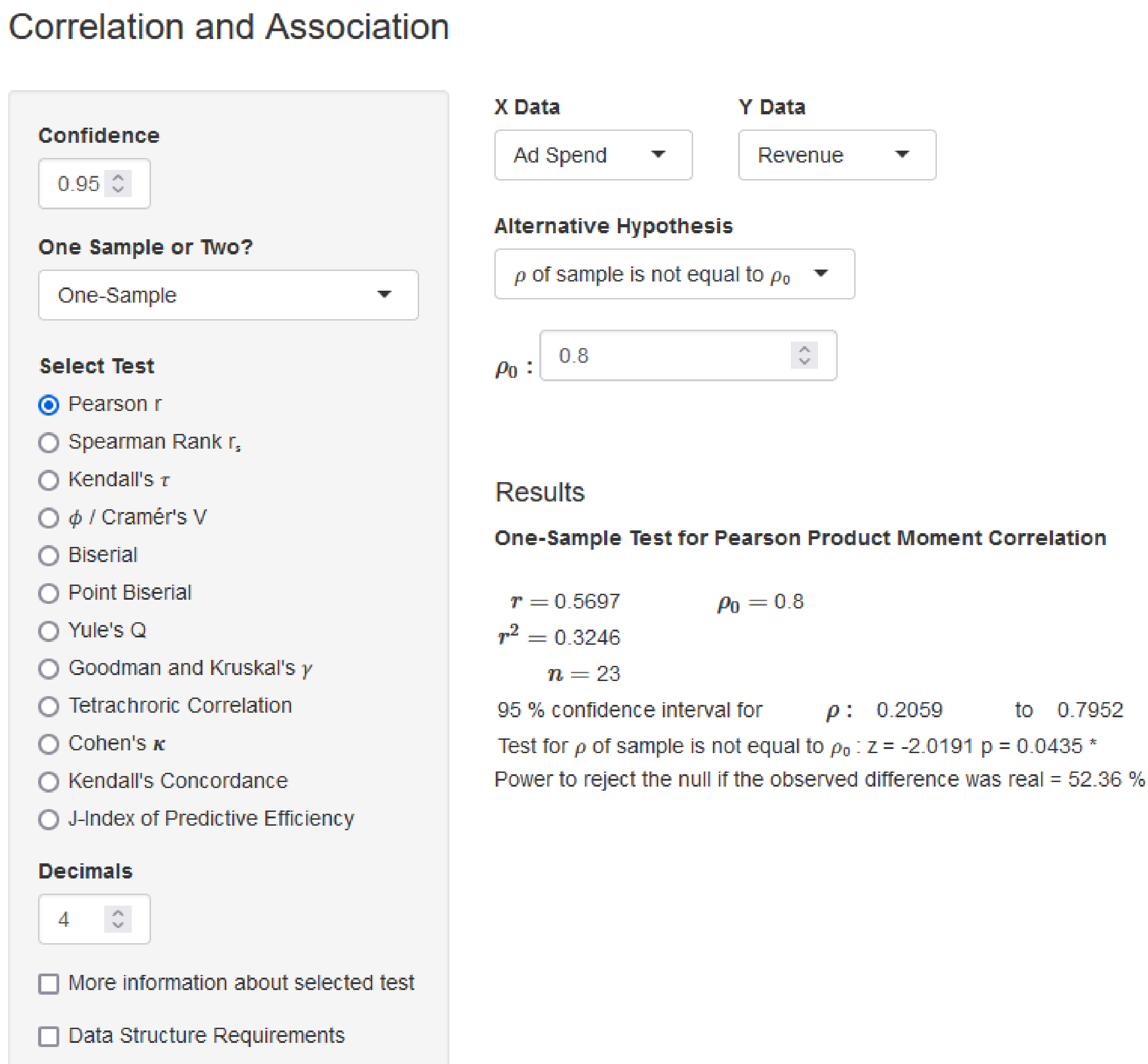
You then select which column you want for the **X Data** and **Y Data**. The Pearson r will be calculated and displayed along with the One-Sample Test for Correlation. In the example, we are testing to see if there is any correlation at all, so make sure that **ρ_0** = 0. It is a non-directional test, so make sure the **Alternative Hypothesis** is **ρ of sample is not equal to ρ_0**.



Note that the coefficient of determination, r^2, is also displayed in the output.

One-Sample Approximate Test for Correlation, ρ = X

This test only requires that you change the null parameter from 0 to whatever null you are testing. In the example, the $\boldsymbol{\rho_0}$ = 0.8. Again, it is a non-directional test, so make sure the **Alternative Hypothesis** is **ρ of sample is not equal to $\boldsymbol{\rho_0}$**.



Linear Regression

Making a Scatterplot

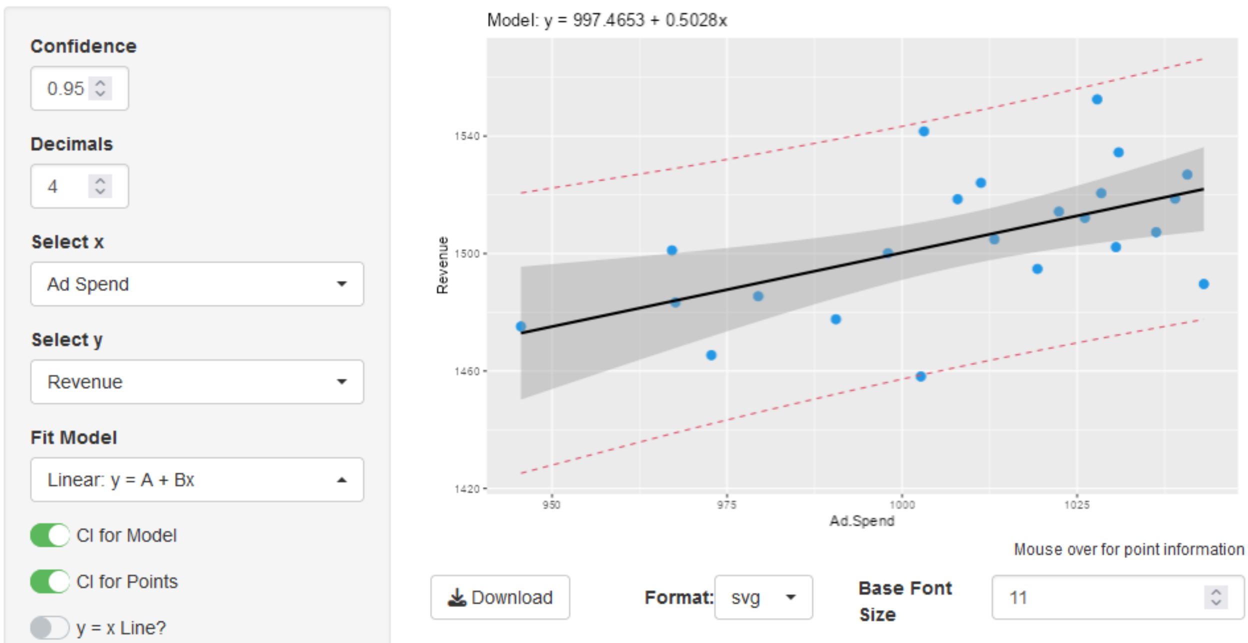
The example in the book again uses the data file FACESPACEADS.CSV. Once the data is loaded select **Correlation and Association** from the menu, then the **Scatterplot** tab. You need to **Select X** and **Select Y**. For regression, it matters which one you select for each, so make sure you select **Ad Spend** for x and **Revenue** for y.

You can select **Confidence** and **Decimals**. You can adjust the **Base Font Size** and **Download** the graph in a variety of **Formats**. You can add a **y = x Line** by clicking on the slider. You can get information for each point by hovering the mouse pointer over it.

Adding a Regression Line

Once the scatterplot is set up, you can add a regression line for a variety of **Fit Models**. The example in the book is a simple linear model. Selecting a model opens up new options where you can turn **CI for Model** and **CI for Points** on and off. Selecting a model also creates a One-Sample Pearson r test for $\rho_0 = 0$ for that model.

Scatterplot



One-Sample Test for Pearson Product Moment Correlation

$r = 0.5697$ $\rho_0 = 0$

$r^2 = 0.3246$

$n = 23$

95 % confidence interval for ρ : 0.2059 to 0.7952

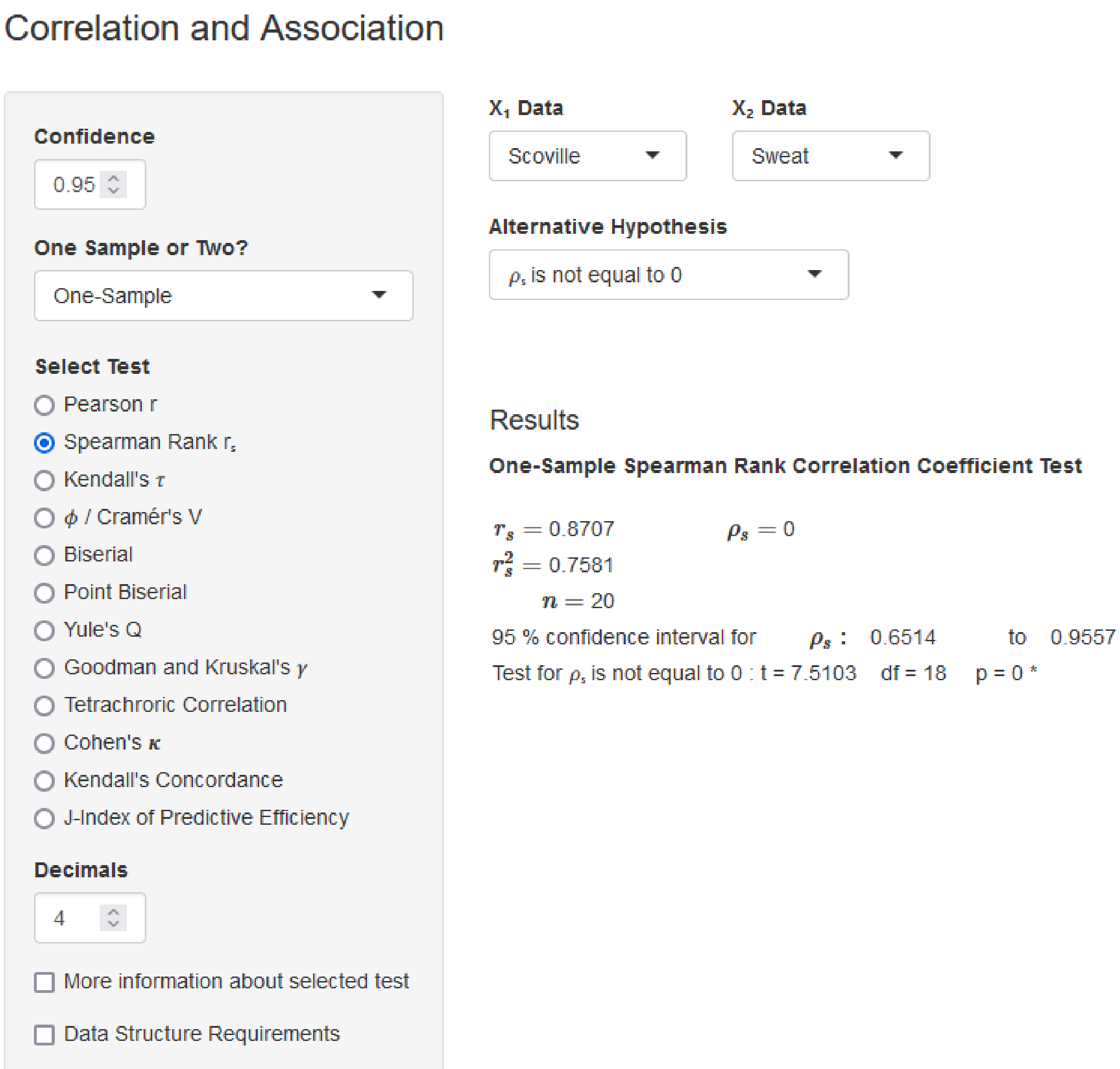
Test for ρ of sample is not equal to ρ_0 : t = 3.1769 df = 21 p = 0.0045 *

Power to reject the null if the observed difference was real = 82.49 %

Correlation of Ordinal Data – Spearmans r_s

The example in the book uses **SWEAT.CSV**. Once that is loaded, select the **Correlation and Association** menu item. We want to **Use Data**, so select that tab.

This is a **One-Sample** test. Choose the **Spearman Rank r_s** test under **Select Test**. Then select the two columns **Scoville** and **Sweat**. You can select the **Confidence** and **Decimals**, and get **More information about the selected test** and **Data Structure Requirements**. It is a non-directional test, so make sure the **Alternative Hypothesis** is **ρ_s is not equal to 0**.

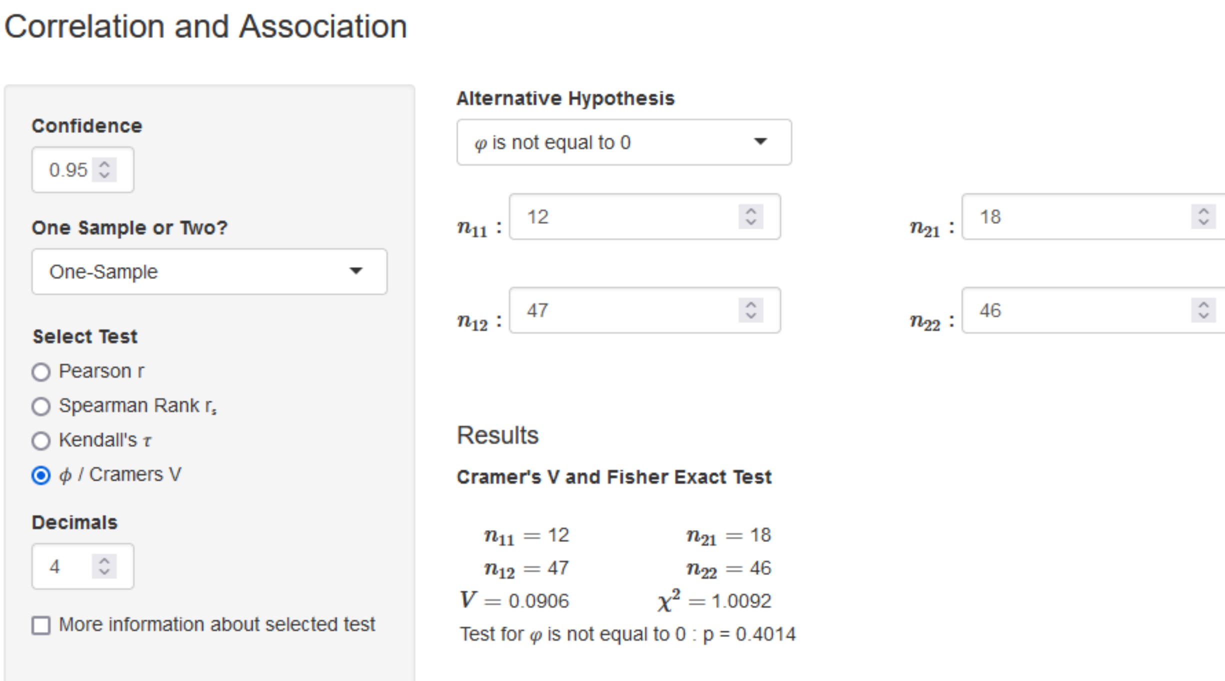


Association of Nominal Data- Cramér's V

This test is also located in the **Correlation and Association** menu item. The example in the book uses counts, so select the **Enter Statistics** tab.

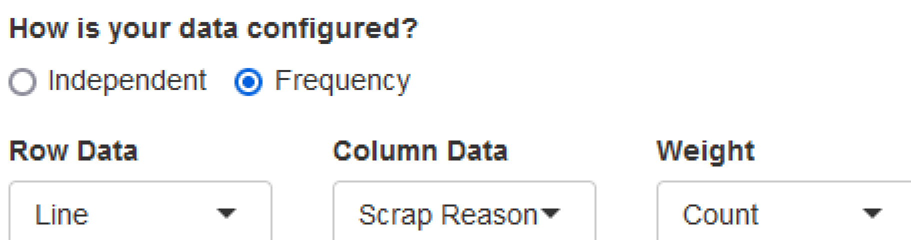
Choose the **ϕ / Cramers V** radio button under **Select Test**. This will change the data input area to show four boxes. This is where you enter the counts from the contingency table. It is a non-directional test, so make sure the **Alternative Hypothesis** is ϕ **of sample is not equal to 0**.

You can select the **Confidence** or get **More information about the selected test**.

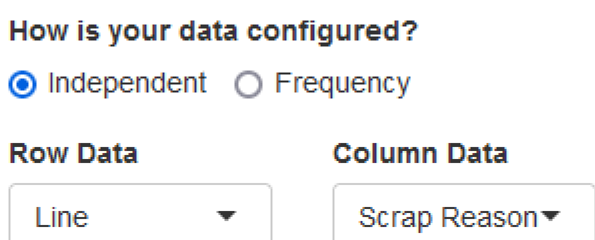


To analyze a contingency table that is more than 2 x 2, you will need to use data, as in the exercise. The data can be set up in short form, where each combination is listed along with a count, or long form, where each line is one count.

To set up the short form, select **Frequency** for **How is your data configured?** Then choose whichever column you want for the **Row Data** and **Column Data**. The **Weight** is the count.



If you use the long form, select Independent for **How is your data configured?** Then choose whichever column you want for the **Row Data** and **Column Data**.



ROIstat handles both numeric and text descriptions for your contingency tables.

Chapter 12 – Two-Sample Hypothesis Tests

Independent Tests

Two-Sample Independent Test for the Average and Dispersion

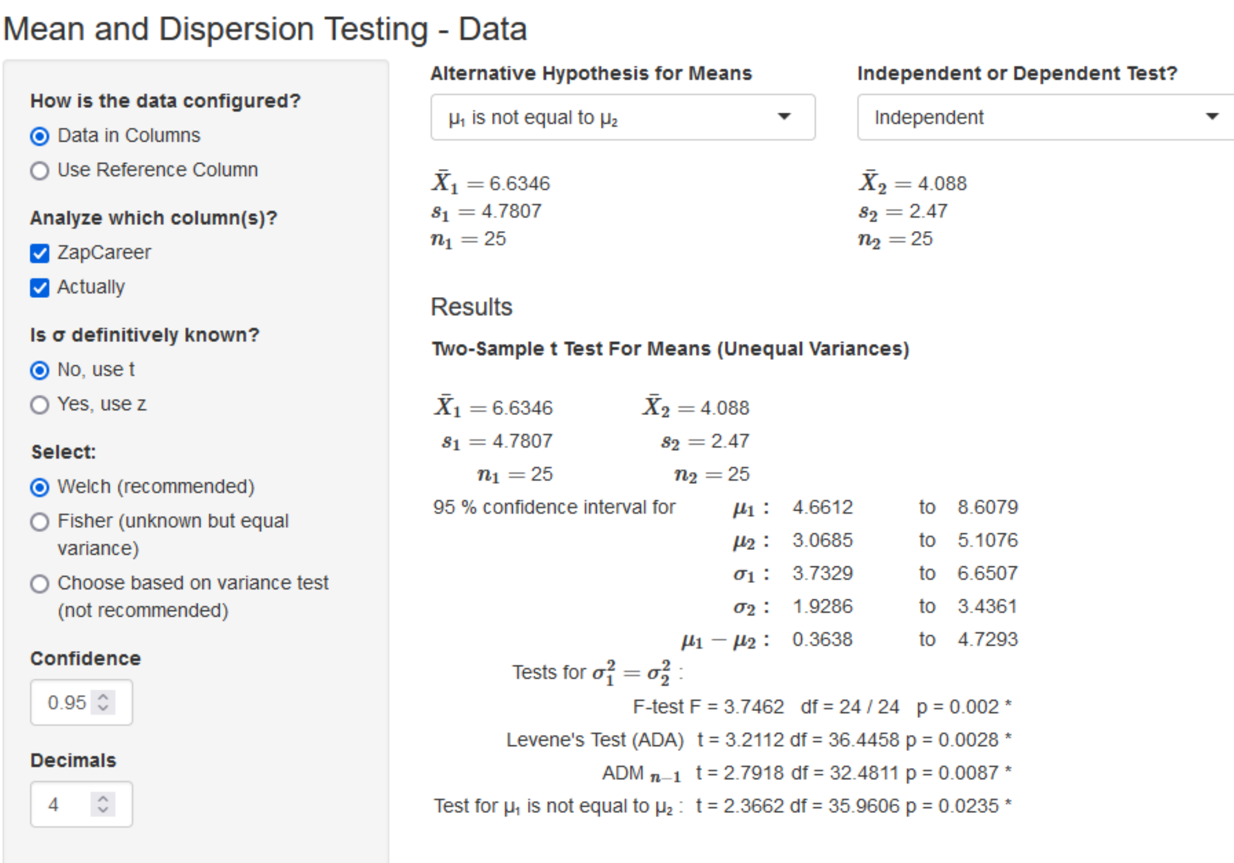
The example in the book uses the data file ZAP_V_ACTUALLY.CSV. Once that is loaded, click on the **One- and Two-Sample Tests** menu dropdown, and then **Means and Dispersion**. We will Use Data, so select that tab.

Each vendor is in a column, so select **Data in Columns** for **How is the data configured?** Then click the checkbox next to each column under **Analyze which column(s)?** The top column selected is Group 1 and the lowest column selected is Group 2.

By selecting two columns, ROIstat knows you are doing a two-sample test. Make sure that the **Independent** test is selected under **Independent or Dependent Test?** and that the **Alternative Hypothesis for Means** is **μ_1 is not equal to μ_2.**

We will only use the t-test with real data, so under **Is σ definitively known?** Choose **No, use t**. We recommend that you **Select** the **Welch** test.

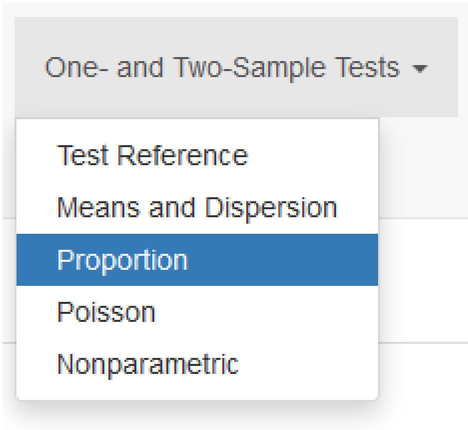
You can set your **Confidence** and **Decimals**.



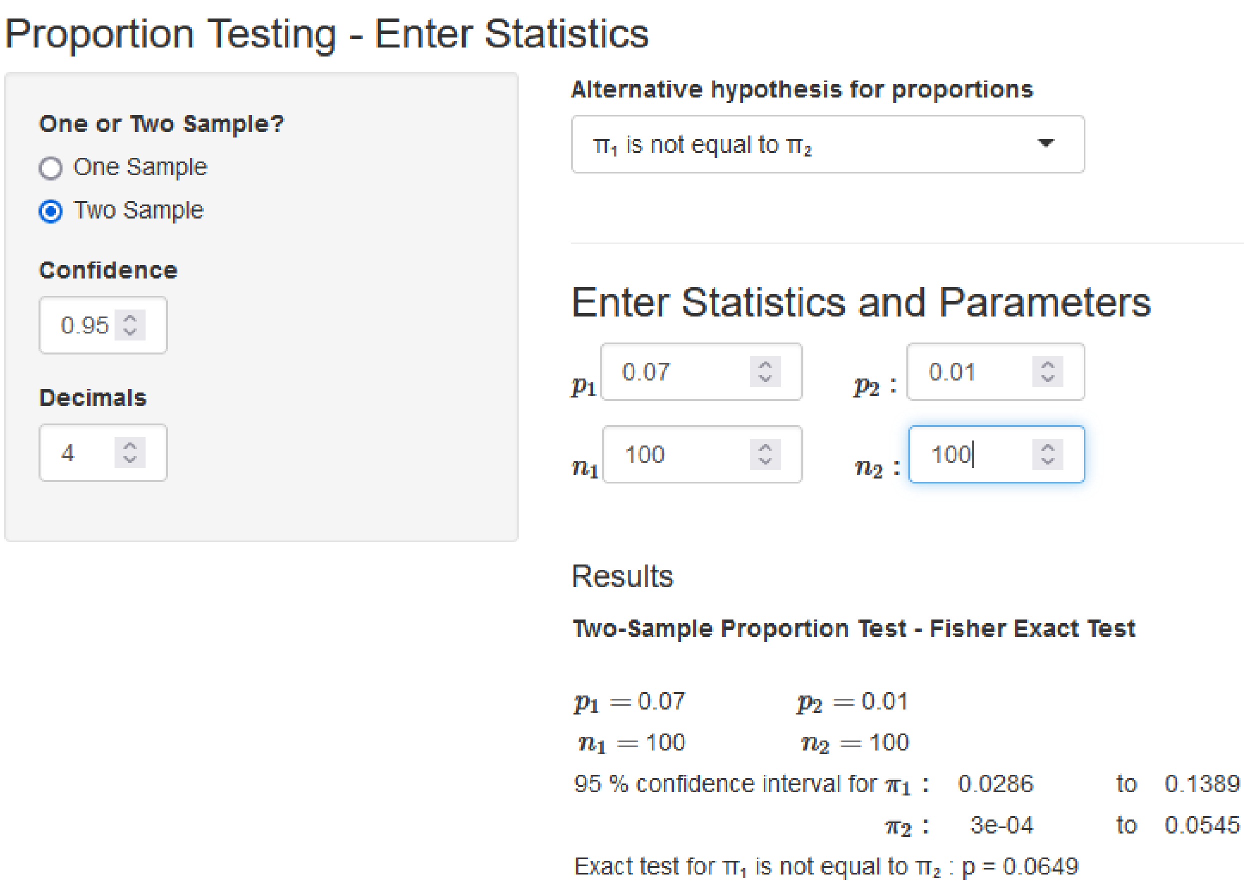
The output gives you the results from a number of different dispersion tests.

Two-Sample Independent Proportion Test

Click on **Proportion** under the **One- and Two-Sample Tests** menu dropdown.

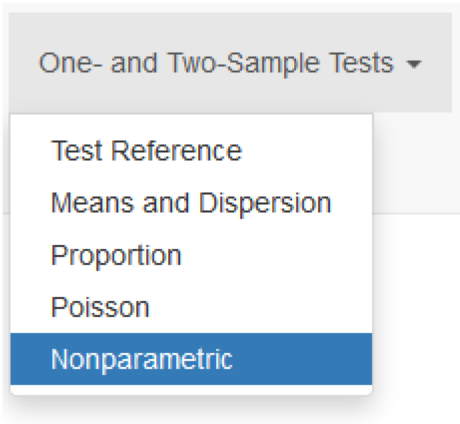


The problem in the book enters the proportions, so make sure the **Enter Statistics** tab is selected. This is a **Two Sample** test. You can adjust the **Confidence** and **Decimals**.



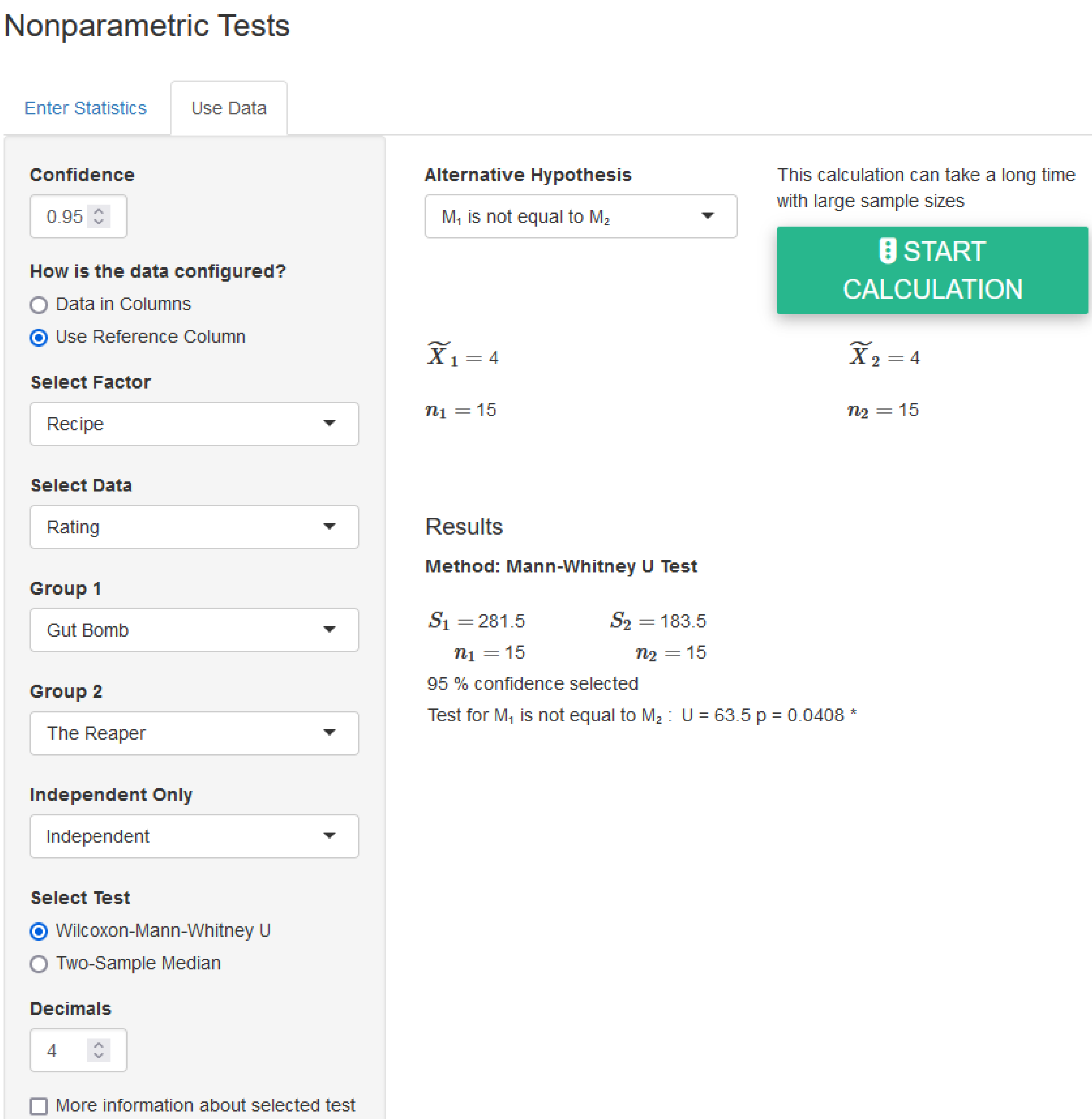
Wilcoxon-Mann-Whitney Test

The example uses the data set **CHILIHEAD.DAT**. Once the data is loaded, select the **Nonparametric** tests under the **One- and Two-Sample Tests** menu dropdown.



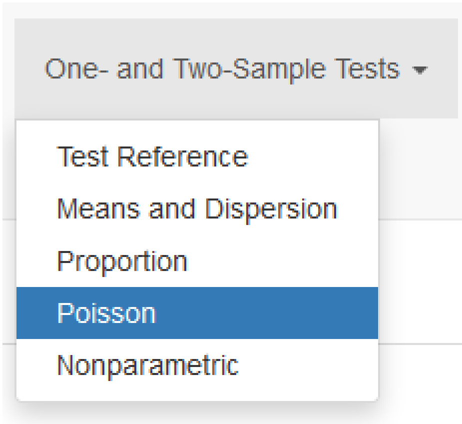
Since we have data, select the Use Data tab. In this example, the data is set up to have one column with the product name and one column with the rating, so select **Use Reference Column** under **How is the data configured?**

You then need to **Select the Factor** column and **Select the Data** column. Select **Group 1** as **Gut Bomb** and **Group 2** as **The Reaper** for the analysis. Under **Select Test** click on the **Wilcoxon-Mann-Whitney U**. You can adjust the **Confidence** and **Decimals** as needed. This calculation can take a while if there is a large data set, so to get the analysis started click on the **Start Calculation** button.

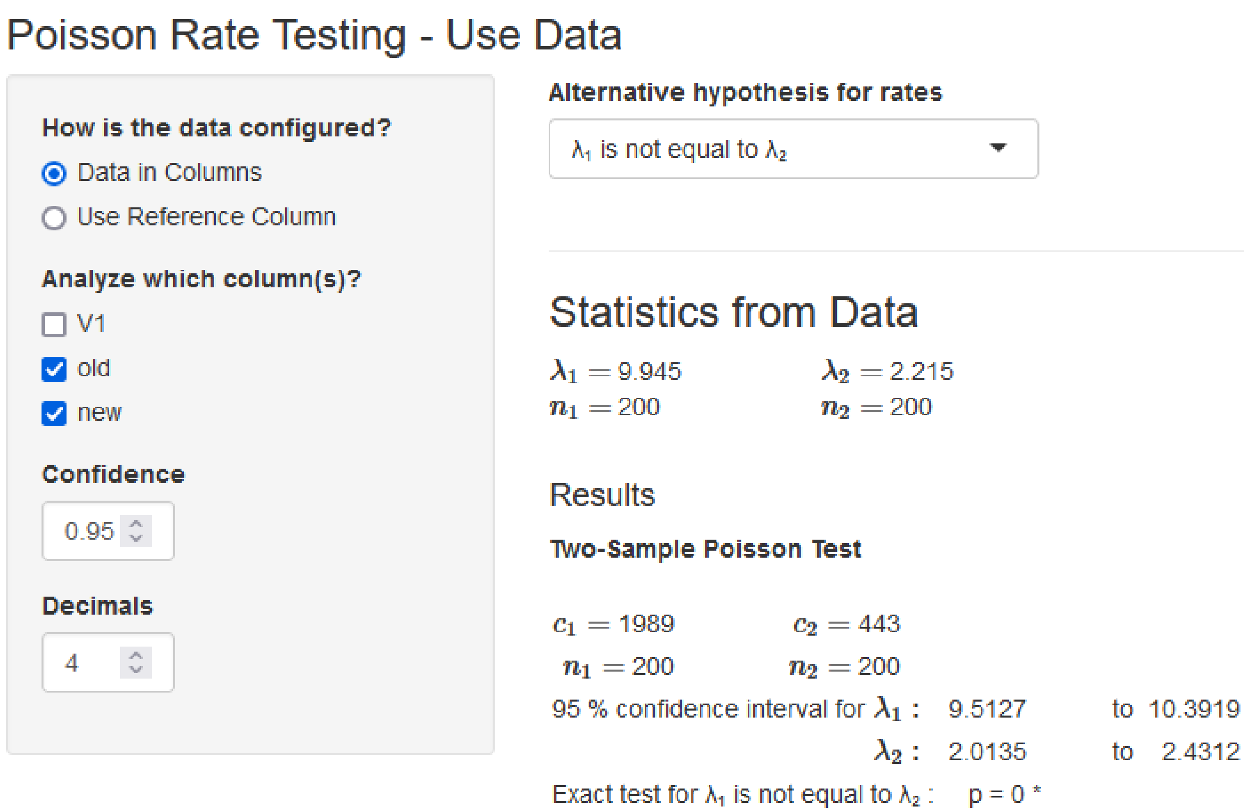


Two-Sample Independent Test for Rates (Poisson)

This example uses the data file **BURNT_CHIPS.CSV**. Once that is loaded, select **Poisson** under the **One- and Two-Sample Tests** menu dropdown.



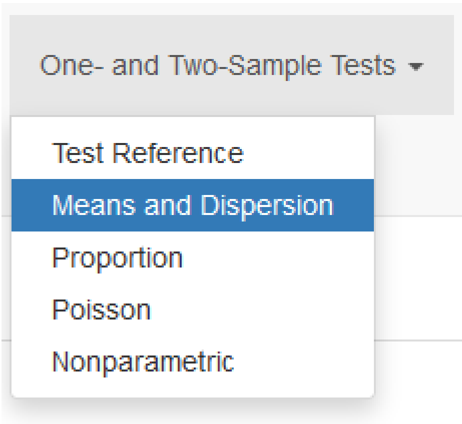
Since we have a data set, select the **Use Data** tab. The **Data is in Columns**, so select that for **How is the data configured?** Select the **old** and **new** columns by clicking on the checkboxes next to them. By clicking on two columns, ROIstat knows you are doing a two-sample test. You can adjust the **Confidence** and **Decimals**. This is a non-directional test, so make sure the **Alternative hypothesis for rates** is **λ_1 is not equal to λ_2**.



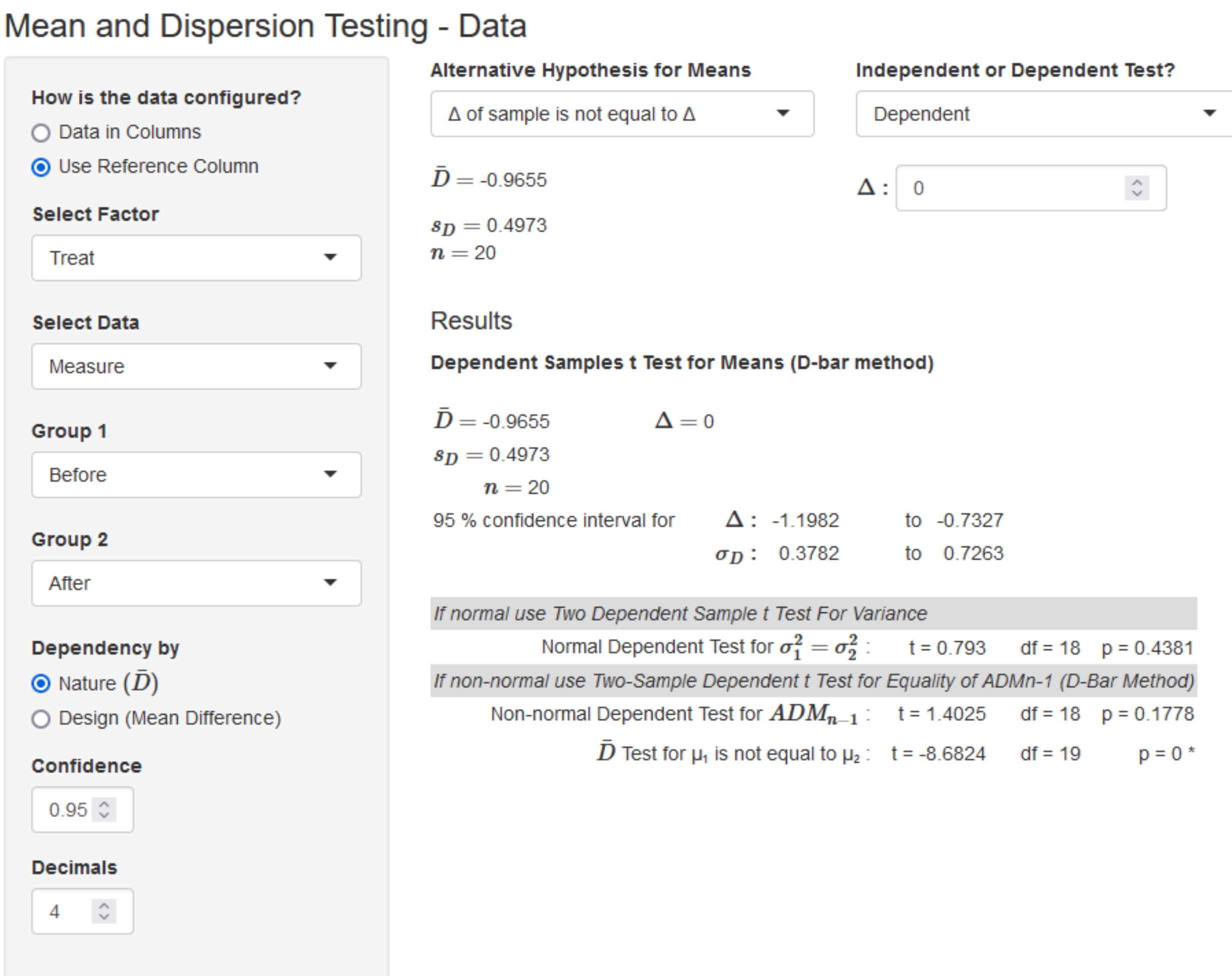
Dependent Tests

Repeated Measures t-Test for Averages

The example uses **IND_DEP_DATA_LONG.CSV**, so once that is loaded select **Means and Dispersion** under the **One- and Two-Sample Tests** menu dropdown.

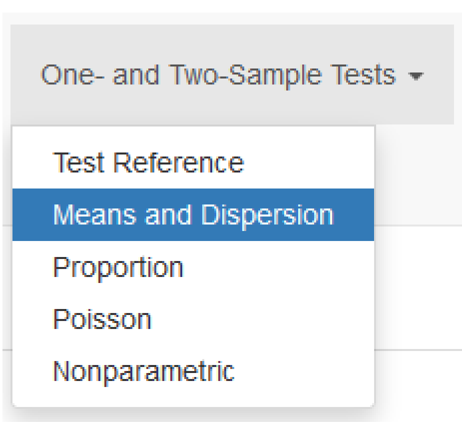


The data **Uses** a **Reference Column**, so select that under **How is the data configured?** Select the **Factor** as **Treat** and **Select the Data** as **Measure**. Then select the two **Groups** as **Before** and **After**. This is a **Dependent** test, so select that under **Independent or Dependent Test?** This example is a repeated measures *t*-test, so it is **Dependency by Nature ($\overline{D}$)** so make sure that is selected. It is a non-directional hypothesis so select **Δ of sample is not equal to Δ** under **Alternative Hypothesis for Means**. As usual, you can select the **Confidence** and **Decimals**.

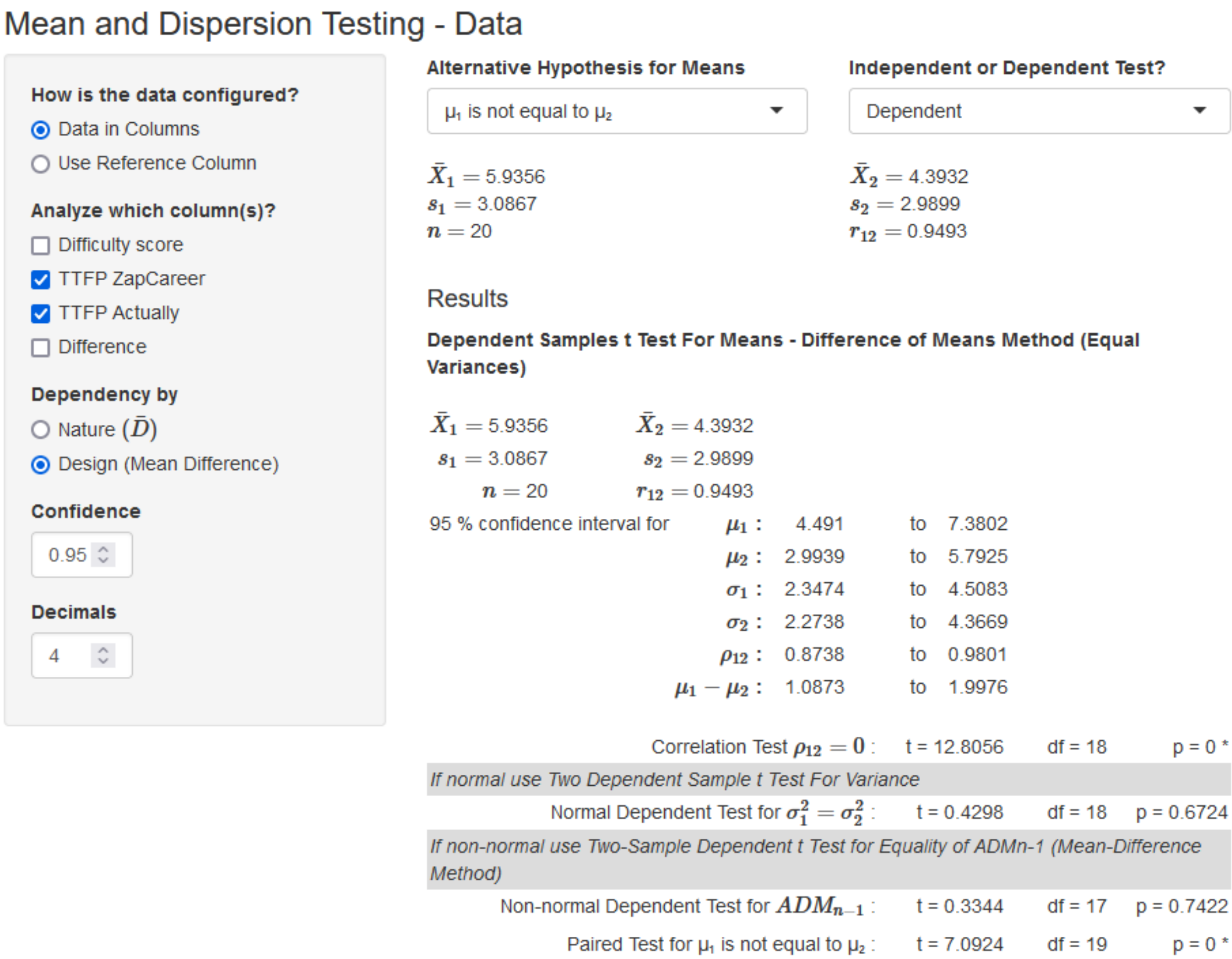


Matched Pairs t-test for Averages and Dispersion

The example uses **ZAP_V_ACTUALLY_PAIRED.CSV**, so once that is loaded select **Means and Dispersion** under the **One- and Two-Sample Tests** menu dropdown.

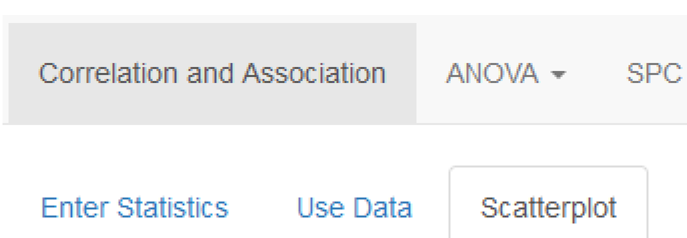


The **Data is in Columns**, so select that under **How is the data configured?** Select the two columns **TTFP ZapCareer** and **TTFP Actually** under **Analyze which column(s)?** This is a **Dependent** test, so select that under **Independent or Dependent Test?** This example is a paired t-test, so it is **Dependency by Design (Mean Difference)** so make sure that is selected. It is a non-directional hypothesis so select **μ_1 is not equal to μ_2** under **Alternative Hypothesis for Means**. As usual, you can select the **Confidence** and **Decimals**.

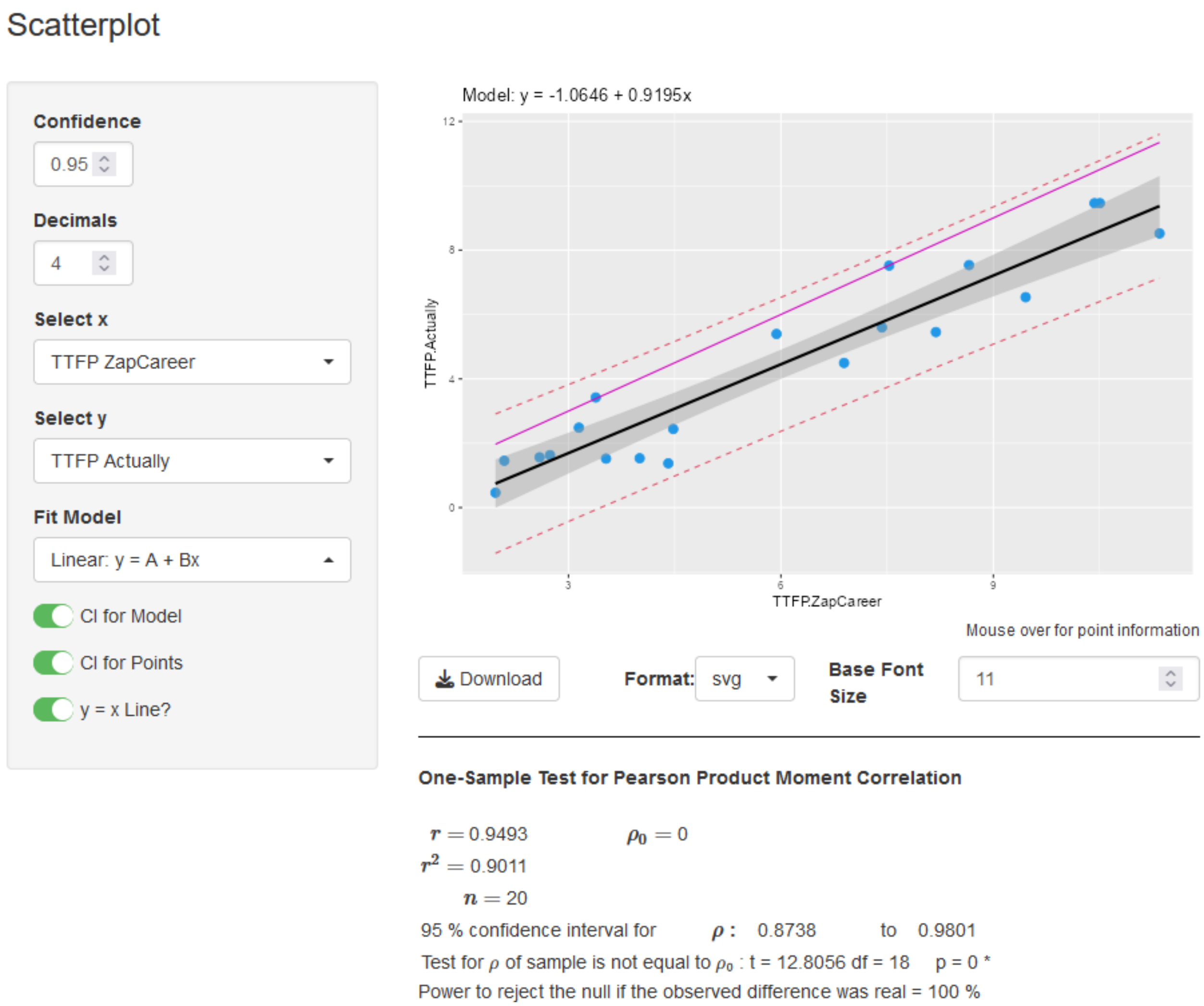


The dependent *t*-test for variance and dispersion are included in the output, as well as the test for correlation.

To make the scatter plot with the iso-line, select Correlation and Association from the menu, then the Scatterplot tab.



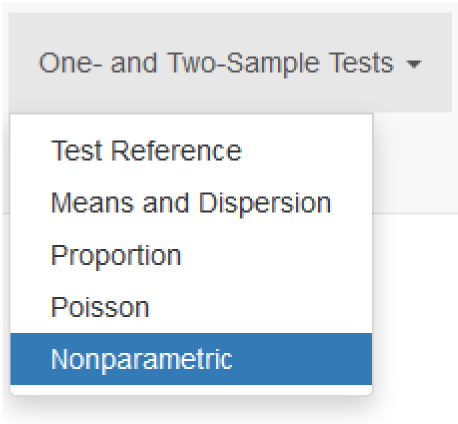
Select x as **TTFP ZapCareer** and **Select y** as **TTFP Actually**. This will create a scatterplot. Add the line by selecting **Linear: y = A + Bx** under **Fit Model**. Include the model and point confidence intervals by clicking on **CI for Model** and **CI for Points**. Add the iso-line by clicking **on y = x Line?** This analysis was done at α = 0.05, so select a **Confidence** of 0.95 and adjust **Decimals** as you like.



Once you select a model, ROIstat will calculate the significance of the *r* for that model. You can change the **Base Font Size** and **Download** the graph in a variety of **Formats**.

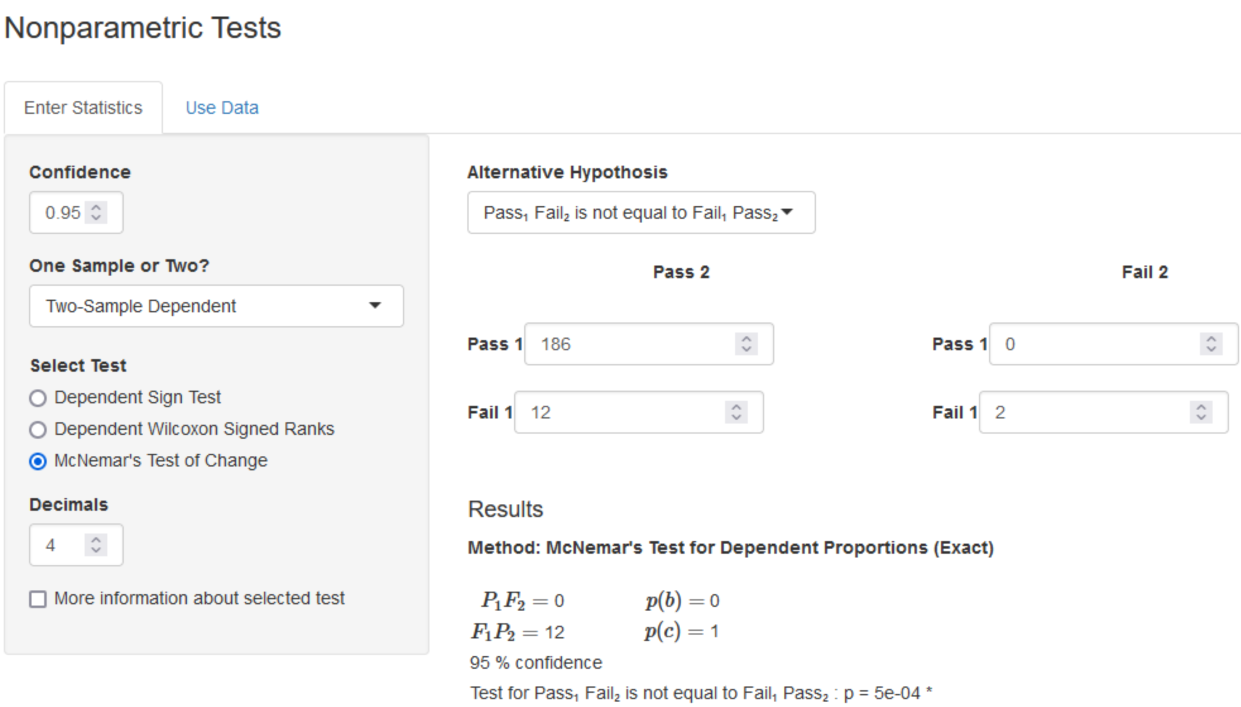
McNemar's Test of Change

Select **Nonparametric** under the **One- and Two-Sample Tests** menu dropdown.



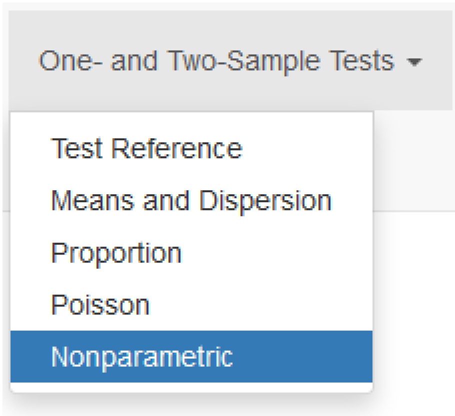
This test was at an $\alpha = 0.05$, so select a **Confidence** of 0.95 and choose the number of **Decimals**. We will be entering the counts directly, so select the **Enter Statistics** tab. This is a **Two-Sample Dependent** test, so select that under **One Sample or Two?** This will change the available test, so select **McNemar's Test of Change** under **Select Test**. This is a non-directional test, so select **$Pass_1$ $Fail_2$ is not equal to $Fail_1$ $Pass_2$** under the **Alternative Hypothesis**.

That will change the data entry to look like a contingency table. Enter the counts in the boxes.



Two-Sample Dependent Sign Test

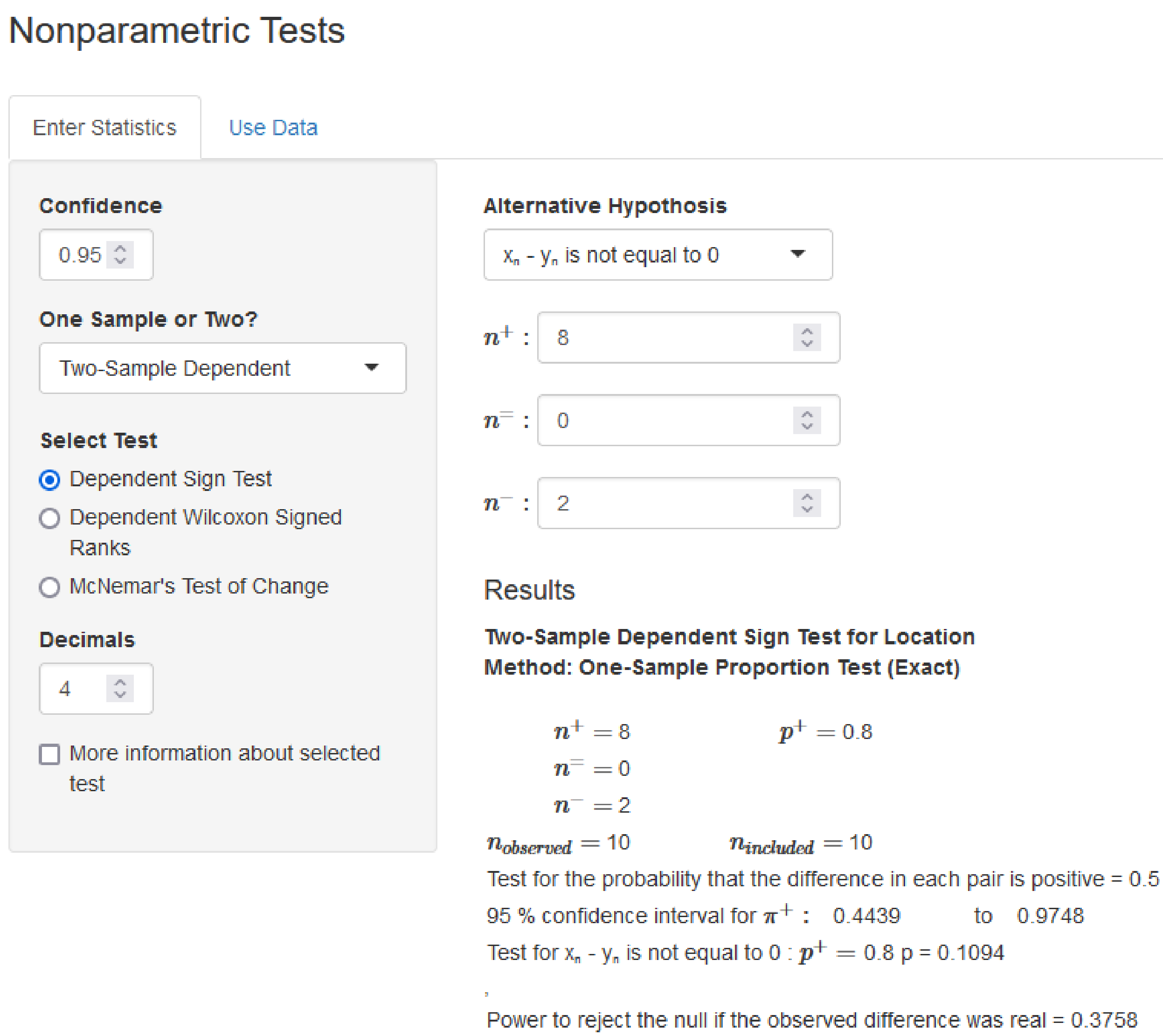
This test is found by clicking **Nonparametric** under the **One- and Two-Sample Tests** menu dropdown.



You are given the counts in this problem, so select the **Enter Statistics** tab. The α = 0.05 so enter a **Confidence** of 0.95. This is a **Two-Sample Dependent** test, so select that under **One Sample or Two?** then **Select** the **Dependent Sign Test**. You can adjust **Decimals** as needed. You can also get **More information about the selected test** by clicking on the checkbox.

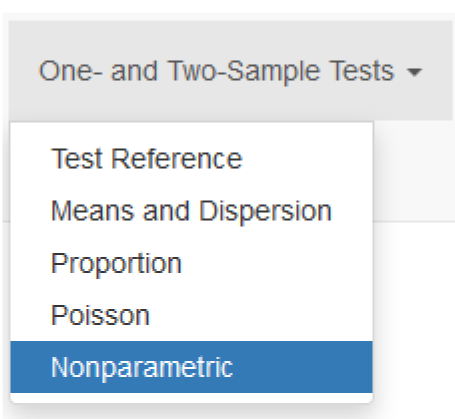
This is a non-directional test, so make sure the **Alternative Hypothesis** is set **to $x_n - y_n$ is not equal to 0**.

Enter the counts into the boxes.



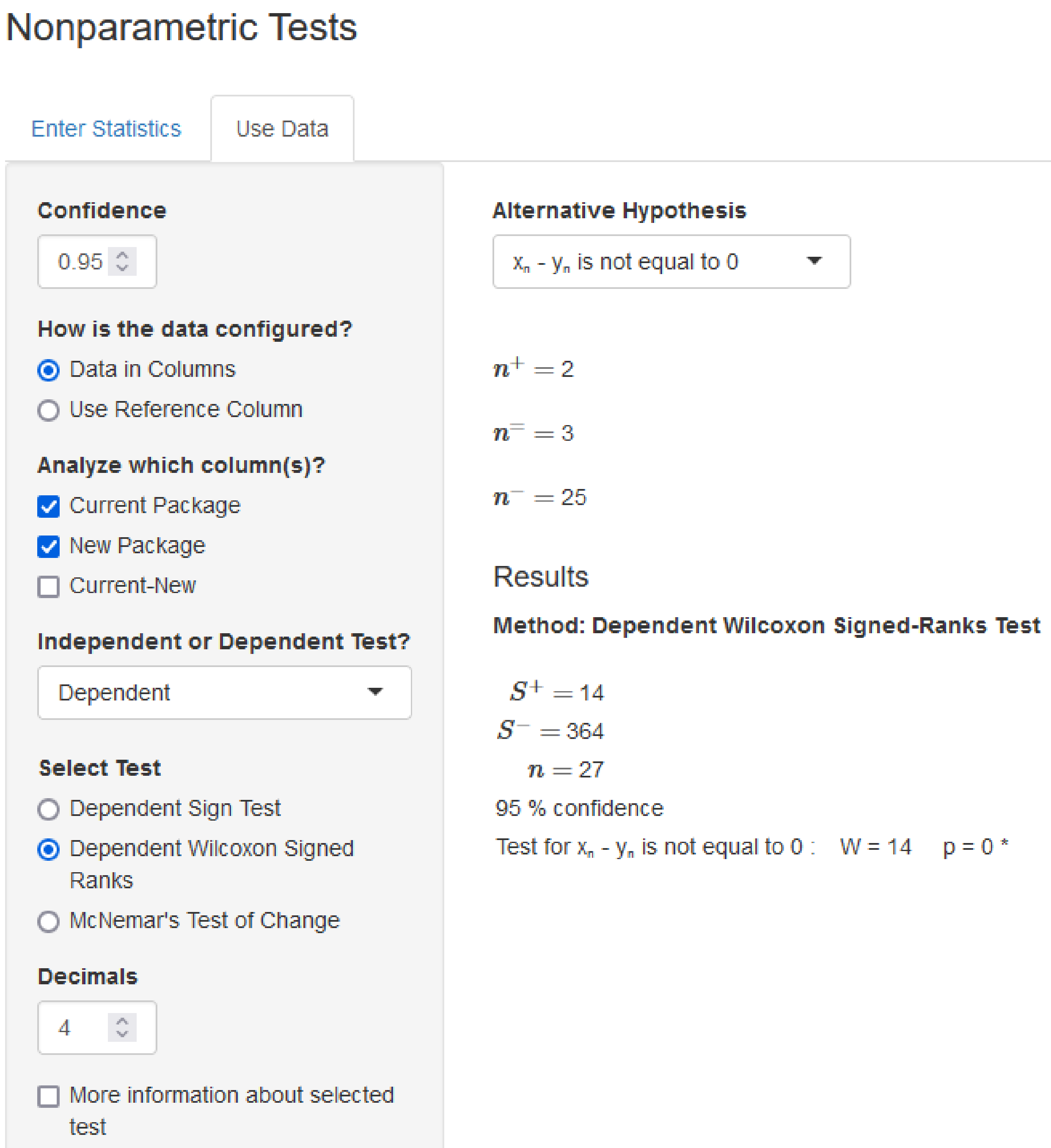
Wilcoxen Signed-Rank Test

This example uses data, so once **CHILIHEAD_DEP.TXT** is loaded, click on **Nonparametric** under the **One- and Two-Sample Tests** menu dropdown.



Select the **Use Data** tab. The **Data is in Columns** so select that under **How is the data configured?** Select the two columns **Current Package** and **New Package** under **Analyze which column(s)?** This is at an α = 0.05 so select a **Confidence** of 0.95. You can adjust the Decimals shown.

This is a **Dependent** test, so select that under **Independent or Dependent Test?** The example is non-directional, so make sure the **Alternative Hypothesis** is set **to $x_n – y_n$ is not equal to 0**.

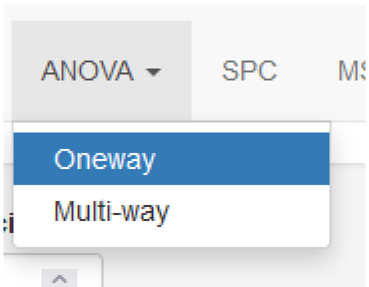


You can get **More information about the selected test** by clicking on the checkbox.

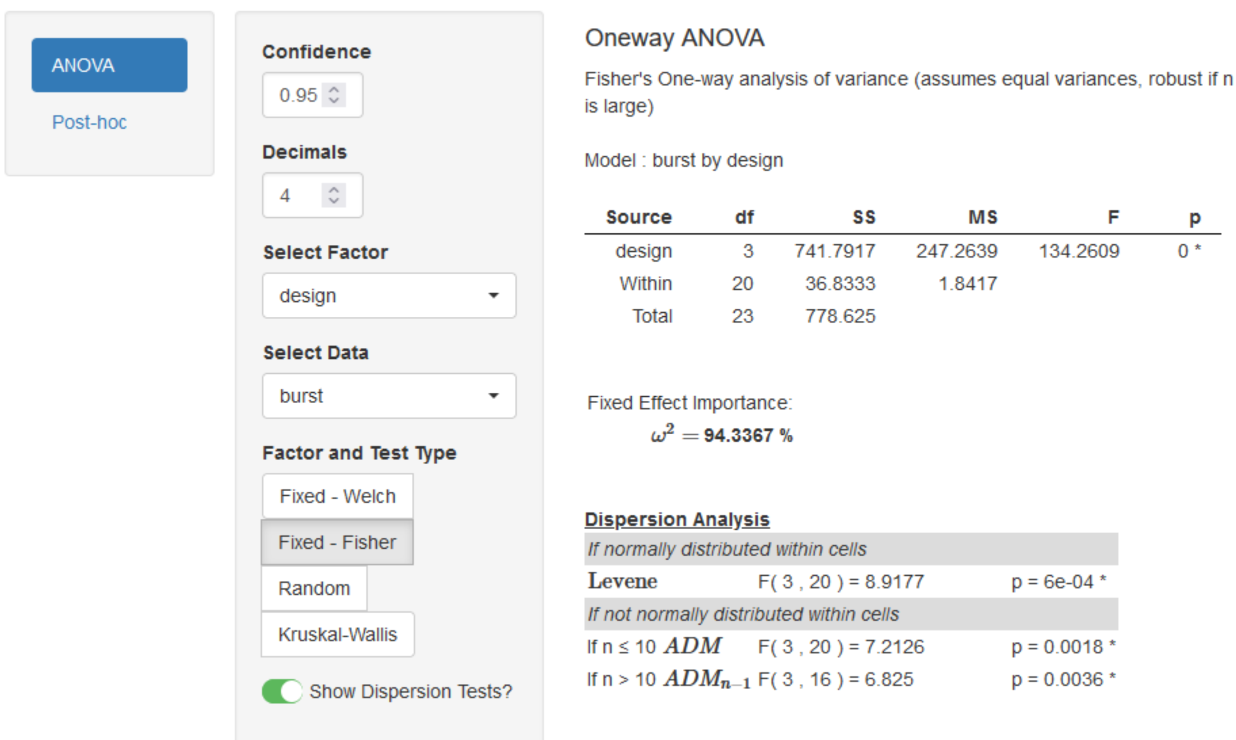
Chapter 13 – Analysis of Variance

One-Way Fixed Factor ANOVA – Means, Importance, and Dispersion Analysis

The example uses the data file **PACKAGE.CSV**. After loading that, select **Oneway** under the **ANOVA** menu dropdown.



Make sure that **ANOVA** is selected first. This example uses an α = 0.05, so set the **Confidence** to be 0.95. You can choose the number of **Decimals**. **Select the Factor** as **design** and **Select the Data** as **burst**. This example demonstrates the **Fixed – Fisher ANOVA**, so select that under **Factor and Test Type**. Select **Show Dispersion Tests?**



Importance is shown under the ANOVA source table.

One-Way Fixed Factor *Post-Hoc* Analysis and Graph

To continue the analysis above, select **Post-hoc**.

Select Post-Hoc as **Tukey (equal variances)** to get the Tukey's HSD test, or select **Games & Howell (unequal variances)** to get that test. The confidence for the test is set on the **ANOVA** tab.

ANOVA

Post-hoc

Decimals

4

Add Lines?

Choose plot type

- ○ Points Only
- ○ Violin
- ◉ Boxplot

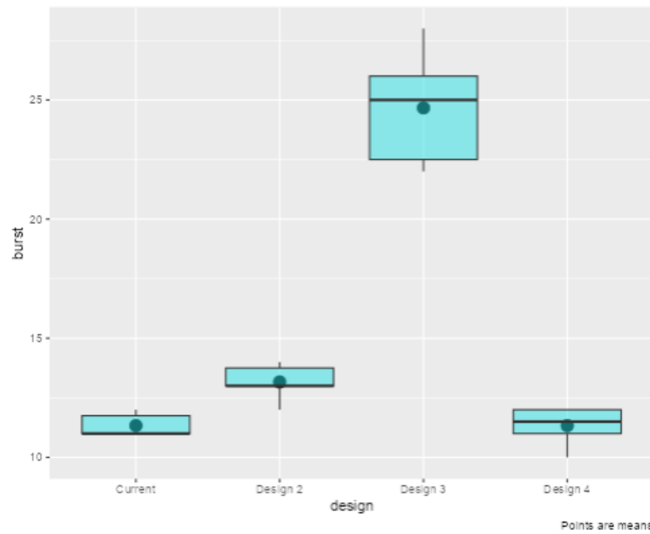
Select Post-Hoc

- ◉ Tukey (equal variances)
- ○ Games & Howell(unequal variances)

☐ Post-hoc Details?

Oneway ANOVA Post-hoc

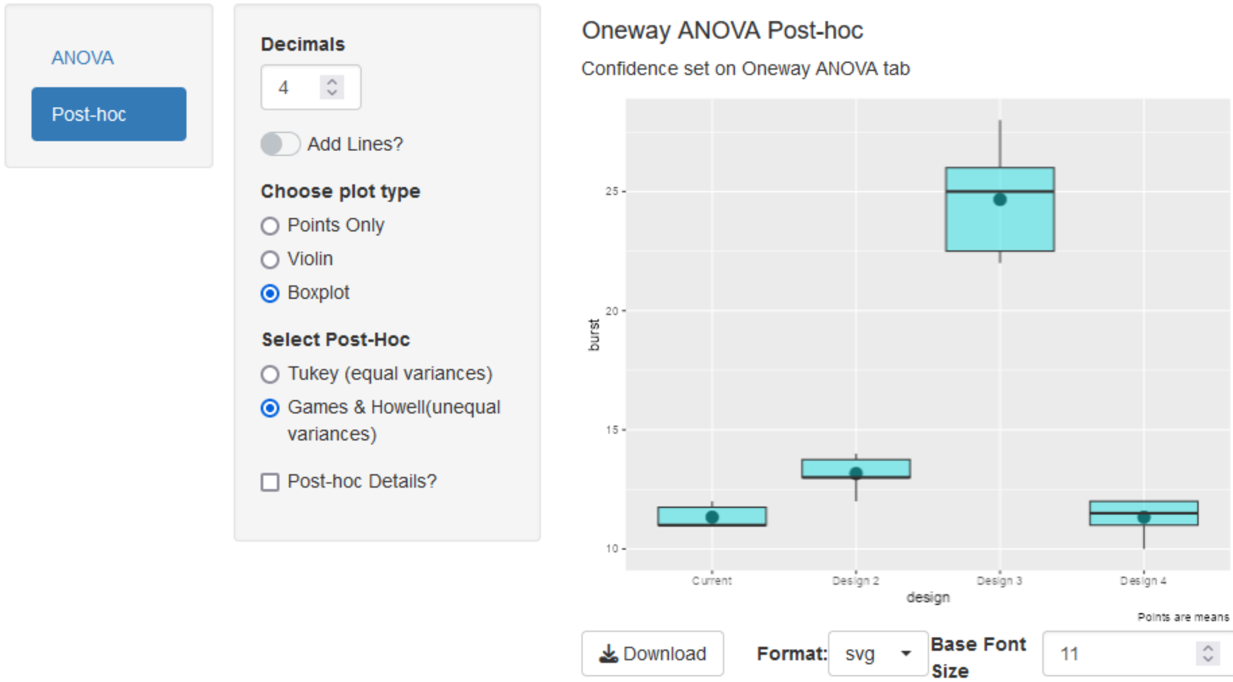
Confidence set on Oneway ANOVA tab



Download **Format:** svg **Base Font Size** 11

Tukey's HSD

	Current	Design 4	Design 2	Design 3
Current				Reject
Design 4				Reject
Design 2				Reject
Design 3	Reject	Reject	Reject	



Games & Howell

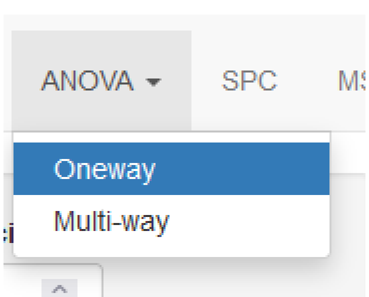
	Current	Design 4	Design 2	Design 3
Current			Reject	Reject
Design 4			Reject	Reject
Design 2	Reject	Reject		Reject
Design 3	Reject	Reject	Reject	

If you want the results of all the post-hoc tests, click the checkbox next to **Post-hoc Details?**

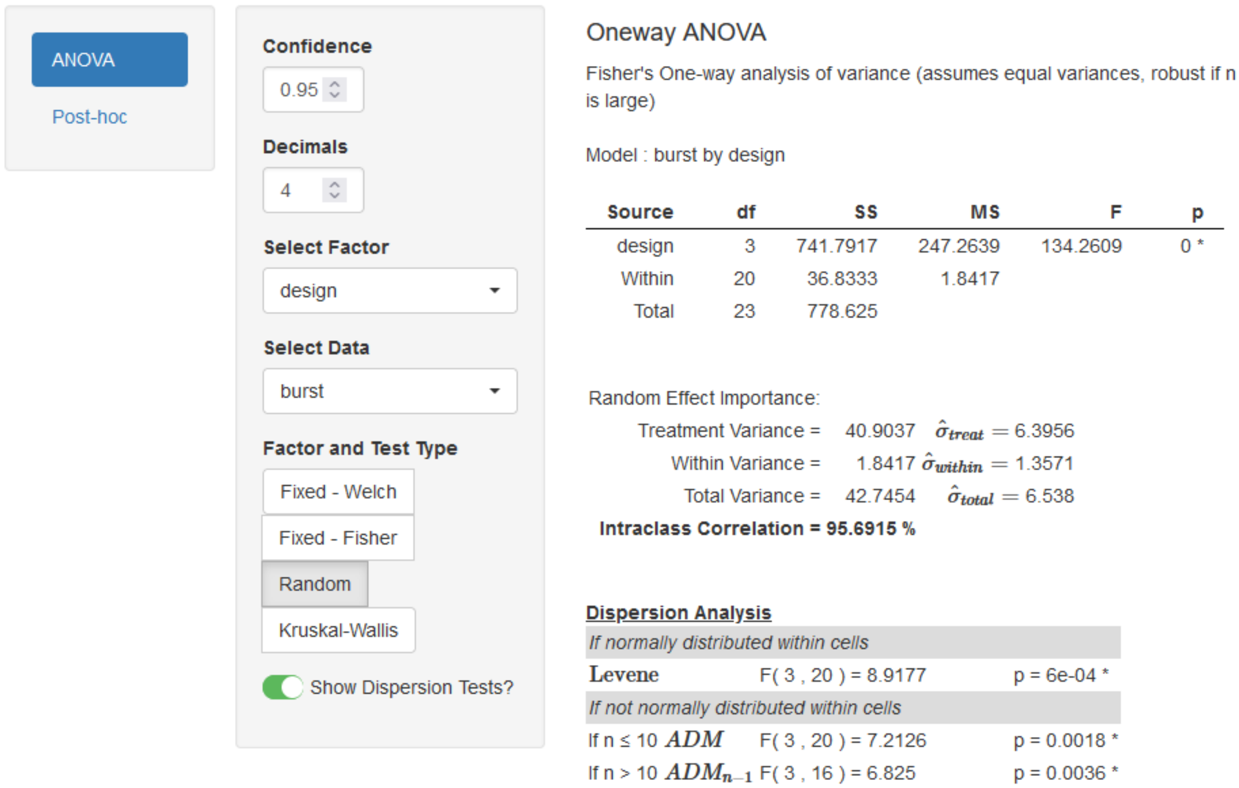
ROIstat automatically generates a graph for you. **You can Add Lines?** connecting the means or medians, you can **Choose a Plot Type** as **Points Only**, **Violin**, or **Boxplot**. You can change the **Base Font Size** and **Download** the graphic in a number of **Formats**.

One-Way Random Effects ANOVA – Variance Contribution, Importance, and Dispersion Analysis

The random effects ANOVA example uses the same data as the fixed effect example, so load the data file PACKAGE.CSV and select **Oneway** under the **ANOVA** menu dropdown.



Make sure that **ANOVA** is selected first. This example uses an α = 0.05, so set the **Confidence** to be 0.95. You can choose the number of **Decimals**. **Select the Factor** as **design** and **Select the Data** as **burst**. This example demonstrates the **Random** effects ANOVA, so select that under **Factor and Test Type**. Optionally select **Show Dispersion Tests?**



The importance statistic ICC is reported along with the variance components under the ANOVA source table.

One-Way Random Effects Post-Hoc Analysis

To continue the analysis above, simply click on the Post-hoc tab to generate the random-effects graph and variance components. You can adjust the Decimals shown here.

ANOVA

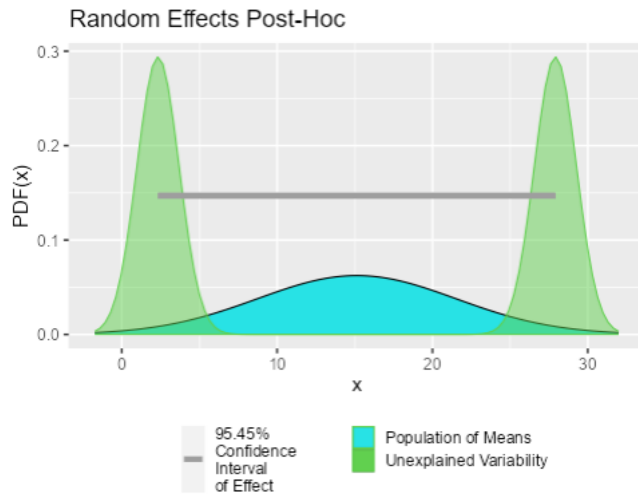
Post-hoc

Decimals

4

Oneway ANOVA Post-hoc

Confidence set on Oneway ANOVA tab



Download **Format:** svg **Base Font Size** 15

Random Effect Importance

Treatment Variance	40.9037	
Within Variance	1.8417	
Total Variance	42.7454	
Interclass Correlation	95.6915 %	
ICC 95 % Confidence Interval	84.9225 %	99.6854 %

You can change the **Base Font Size** and **Download** the graphic in a number of **Formats**.