Section 1.3 Obtaining a Simple Random Sample

1. Select **Data**, highlight **Simulate**, then highlight **Discrete Uniform**.
2. Fill in the window with the appropriate values. To obtain a simple random sample for the situation in Example 2, enter the values shown in the figure below. The reason we generate 10 rows of data (instead of 5) is in case any of the random numbers repeat. Click Compute! and the random numbers will appear in the spreadsheet. *Note:* You could also select the single dynamic seed radio button to set the seed.

![Simulate Discrete Uniform](image)

Section 2.1 Organizing Qualitative Data

**Frequency** or **Relative Frequency Distributions from Raw Data**

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select **Stat**, highlight **Tables**, and select **Frequency**.
3. Click on the variable you wish to summarize. Click the Type of table you want. If you want both Frequency and Relative Frequency, highlight Frequency, then press Shift and select Relative frequency. Click Compute!.

**Bar Graphs from Summarized Data**

1. If necessary, enter the summarized data into the spreadsheet. Name the variable and frequency (or relative frequency) columns.
2. Select **Graph**, highlight **Bar Plot**, then highlight **with summary**.
3. Select the "Categories in:" variable and "Counts in:" variable. Choose the type of bar graph (frequency or relative frequency). Enter labels for the X-axis and Y-axis. Enter a title for the graph. Click Compute!.

**Bar Graphs from Raw Data**

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select **Graph**, highlight **Bar Plot**, then highlight **with data**.
3. Click on the column name of the variable you wish to summarize. Leave the grouping option as "Split bars". Choose the type of bar graph (frequency or relative frequency). Enter labels for the X-axis and Y-axis. Enter a title for the graph. Click Compute!.

**Side-by-Side Bar Graphs from Summarized Data**

1. If necessary, enter the summarized data into the spreadsheet. Name the columns.
2. Select **Graph**, highlight **Chart**, then highlight **columns**.
3. Select the column variables that contain the frequency or relative frequency of each category. Select the column of the variable that has the row labels. Choose the display you would like (vertical or horizontal split bars). Click Compute!.

**Pie Chart from Summarized Data**

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select **Graph**, highlight **Pie Chart**, then highlight **with summary**.
3. Select the "Categories in:" variable and "Counts in:" variable. Choose the display you would like. Enter a title for the graph. Click Compute!.

**Pie Chart from Raw Data**

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select **Graph**, highlight **Pie Chart**, then highlight **with data**.
3. Click on the column name of the variable you wish to summarize. Choose the display you would like. Enter a title for the graph. Click Compute!.

**Section 2.2 Organizing Quantitative Data: The Popular Displays**

**Histograms**

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select **Graph** and highlight **Histogram**.
3. Click on the variable you wish to summarize. Choose the type of histogram (frequency or relative frequency). You have the option of choosing a lower class limit for the first class by entering a value in the cell marked "Start bins at:" You have the option of choosing a class width by entering a value in the cell marked "Binwidth:" Enter labels for the X-axis and Y-axis. Enter a title for the graph. Click Compute!.
Stem-and-Leaf Plots

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select Graph and highlight Stem and Leaf.
3. Click on the variable you wish to summarize. Select None for outlier trimming. Click Compute!.

Dot Plots

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select Graph and highlight Dotplot.
3. Click on the variable you wish to summarize. Enter labels for the X-axis and Y-axis. Enter a title for the graph. Click Compute!.

Section 3.1 Measures of Central Tendency

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select Stat, highlight Summary Stats, and select Columns.
3. Click on the variable you wish to summarize. Deselect any statistics you do not wish to compute by clicking on the statistic. If you wish to compute certain statistics hold down the Control (Ctrl) key when selecting the statistic. Click Compute!.

Section 3.2 Measures of Dispersion

Use the same steps followed to obtain the measures of central tendency.

Section 3.3 Measures of Central Tendency & Dispersion from Grouped Data

1. If necessary, enter the summarized data into the spreadsheet. Name the columns.
2. Select Stat, highlight Summary Stats, and select Grouped/Binned data.
3. Choose the column that contains the class under the "Bins in:" drop-down menu. Choose the column that contains the frequencies in the "Counts in:" drop-down menu. Select the "Consecutive lower limits" radio button for defining the midpoints. Click Compute!.

Section 3.4 Measures of Position and Outliers

Determining Quartiles

Follow the same steps followed to obtain the measures of central tendency.

Section 3.5 The Five-Number Summary and Boxplots

Drawing Boxplots

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select Graph and highlight Boxplot.
3. Click on the variable whose boxplot you want to draw. If you wish to draw side-by-side boxplots, hold the Control key down while clicking the variable. Check the boxes "Use fences to identify outliers" and "Draw boxes horizontally". Enter label for the X-axis. Enter a title for the graph. Click Compute!.
Section 4.1 Scatter Diagrams and Correlation

Scatter Diagrams

1. If necessary, enter the explanatory variable in column var1 and the response variable in column var2. Name each column variable.
2. Select Graph and highlight Scatter Plot.
3. Choose the explanatory variable for the X column and the response variable for the Y column. Enter the labels for the X-axis and Y-axis. Enter a title for the graph. Click Compute!.

Correlation Coefficient

1. If necessary, enter the explanatory variable in column var1 and the response variable in column var2. Name each column variable.
2. Select Stat, highlight Summary Stats, and select Correlation.
3. Click on the variables whose correlation you wish to determine. Click Compute!.

Section 4.2 Least-Squares Regression

Determining the Least-Squares Regression Line

1. If necessary, enter the explanatory variable in column var1 and the response variable in column var2. Name each column variable.
2. Select Stat, highlight Regression, and select Simple Linear.
3. Choose the explanatory variable for the X variable and the response variable for the Y variable. If you want, enter a value of the explanatory variable to Predict Y for X. If you want the least-squares regression line drawn on the scatter diagram, highlight Fitted line plot under Graphs. Click Compute!.

Section 4.3 Diagnostics on the Least-Squares Regression Line

The Coefficient of Determination, $R^2$

Follow the same steps used to obtain the least-squares regression line. The coefficient of determination is given as part of the output (R-sq).

Residual Plots

1. If necessary, enter the explanatory variable in column var1 and the response variable in column var2. Name each column variable.
2. Select Stat, highlight Regression, and select Simple Linear.
3. Choose the explanatory variable for the X variable and the response variable for the Y variable. Under Graphs, select Residuals vs. X-values. Click Compute!.

Section 4.4 Contingency Tables and Association

Contingency Tables

1. Enter the contingency table into the spreadsheet. The first column should be the row variable. For example, for the data in Table 9, the first column would be employment status. Each subsequent column
would be the counts of each category of the column variable. For the data in Table 9, enter the counts for each level of education. Title each column (including the first column indicating the row variable).

2. Select Stat, highlight Tables, select Contingency, then highlight with summary.
3. Select the column variables. Then select the label of the row variable. For example, the data in Table 9 has four column variables (Did Not Finish High School, and so on) and the row label is employment status. Decide what values you want displayed. Typically, we choose row percent and column percent for this section. Click Compute!.

Section 5.1 Probability Rules

Simulation

1. Select Data, highlight Simulate Data, then highlight Discrete Uniform.
2. Enter the number of random numbers you would like generated in the "Rows" cell. For example, if you want to simulate rolling a die 100 times, enter 100. Enter 1 in the "Columns" cell. Enter the smallest and largest integer in the "Minimum" and "Maximum" cell, respectively. For example, to simulate rolling a single die, enter 1 and 6, respectively. Select either the dynamic seed or the fixed seed and enter a value of the seed. Click Compute!.
3. To get counts, select Stat, highlight Summary Stats, then select Columns.
4. Select the column the simulated data are located in. In the "Group by" cell, select the column the simulated data are located in. In the "Statistics" cell, only select n. Click Compute!.

Section 6.1 Discrete Random Variables

Finding the Mean and Standard Deviation of a Discrete Random Variable

1. Enter the values of the random variable in column var1 and the corresponding frequencies in column var2. Name each column.
2. Select Stat, highlight Summary Stats, and select Grouped/Binned data.
3. Choose the column that contains the class under the "Bins in:" drop-down menu. Choose the column that contains the frequencies in the "Counts in:" drop-down menu. Select the "Limits" radio button for defining the midpoints. Click Compute!.

Section 6.2 The Binomial Probability Distribution

Computing Binomial Probabilities

1. Select Stat, highlight Calculators, select Binomial.
2. Enter the number of trials, n, and probability of success, p. In the pull-down menu, decide if you wish to compute \( P(X \leq x) \), \( P(X < x) \), and so on. Finally, enter the value of \( x \). Click Compute.

Section 6.3 The Poisson Probability Distribution

Computing Binomial Probabilities

1. Select Stat, highlight Calculators, select Poisson.
2. Enter the mean, \( \mu \). In the pull-down menu, decide if you wish to compute \( P(X \leq x) \), \( P(X < x) \), and so on. Finally, enter the value of \( x \). Click Compute.
Section 7.2 Applications of the Normal Distribution

Finding Areas Under the Standard Normal Curve

1. Select Stat, highlight Calculators, select Normal.
2. Enter the mean and the standard deviation. In the pull-down menu, decide if you wish to compute \( P(X \leq x) \) or \( P(X \geq x) \). Finally, enter the value of \( x \). Click Compute.

Finding Scores Corresponding to an Area

1. Select Stat, highlight Calculators, select Normal.
2. Enter the mean and the standard deviation. In the pull-down menu, decide if you are given the area to the left of the unknown score or the area to the right. If given the area to the left, in the pull-down menu choose the \(<\) option; if given the area to the right, choose the \(\geq\) option. Finally, enter the area in the right-most cell. Click Compute.

Section 7.3 Assessing Normality

Normal Probability Plots

1. If necessary, enter the raw data into column var1. Name the column.
2. Select Graph, highlight QQ Plot.
3. Select the variable. Click Compute!.

Section 9.1 Estimating a Population Proportion

1. If necessary, enter the raw data into column var1. Name the column.
2. Select Stat, highlight Proportion Statistics, highlight One Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.
3. If you chose With Data, highlight the column that contains the data in the “Values in:” drop-down menu. Enter the value that represents a success. If you chose With Summary, enter the number of successes and the number of observations. Choose the confidence interval radio button. Enter the level of confidence. Leave the method as “Standard-Wald”. Click Compute!.

Section 9.2 Estimating a Population Mean

1. If necessary, enter the raw data into column var1. Name the column.
2. Select Stat, highlight T Statistics, highlight One Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.
3. If you chose With Data, highlight the column that contains the data in the “Select column(s):” drop-down menu. If you chose With Summary, enter the sample mean, sample standard deviation, and sample size. Choose the confidence interval radio button. Enter the level of confidence. Click Compute!.

Section 9.3 Estimating a Population Standard Deviation

1. If necessary, enter the raw data into column var1. Name the column.
2. Select Stat, highlight Variance Statistics, highlight One Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.

3. If you chose With Data, highlight the column that contains the data in the “Select column(s):” drop-down menu. If you chose With Summary, enter the sample variance and sample size. Choose the confidence interval radio button. Enter the level of confidence. Click Compute!.

Section 10.2 Hypothesis Tests for a Population Proportion

1. If necessary, enter the raw data into column var1. Name the column.

2. Select Stat, highlight Proportion Statistics, highlight One Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.

3. If you chose With Data, highlight the column that contains the data in the “Values in:” drop-down menu. Enter the value that represents a success. If you chose With Summary, enter the number of successes and the number of observations. Choose the hypothesis test radio button. Enter the value of the proportion stated in the null hypothesis and choose the direction of the alternative hypothesis from the drop-down menu. Click Compute!.

Section 10.3 Hypothesis Tests for a Population Mean

1. If necessary, enter the raw data into column var1. Name the column.

2. Select Stat, highlight T Statistics, highlight One Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.

3. If you chose With Data, highlight the column that contains the data in the “Select column(s):” drop-down menu. If you chose With Summary, enter the sample mean, sample standard deviation, and sample size. Choose the hypothesis test radio button. Enter the value of the mean stated in the null hypothesis and choose the direction of the alternative hypothesis from the drop-down menu. Click Compute!.

Section 10.4 Hypothesis Tests for a Population Standard Deviation

1. If necessary, enter the raw data into column var1. Name the column.

2. Select Stat, highlight Variance Statistics, highlight One Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.

3. If you chose With Data, highlight the column that contains the data in the “Select column(s):” drop-down menu. If you chose With Summary, enter the sample variance and sample size. Choose the hypothesis test radio button. Enter the value of the variance stated in the null hypothesis and choose the direction of the alternative hypothesis from the drop-down menu. Click Compute!.

Section 11.1 Inference about Two Population Proportions

1. If necessary, enter the raw data into columns var1 and var2. Name the columns.

2. Select Stat, highlight Proportion Statistics, highlight Two Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.

3. If you chose With Data, highlight the column that contains the data in the “Values in:” drop-down menu for Sample 1 and Sample 2. Enter the value that represents a success within each sample. If you chose With Summary, enter the number of successes and the number of
observations for each sample. If you choose the hypothesis test radio button, enter the value of the proportion stated in the null hypothesis and choose the direction of the alternative hypothesis from the drop-down menu. If you choose the confidence interval radio button, enter the level of confidence. Click Compute!.

Section 11.2 Inference about Two Means: Dependent Samples

1. If necessary, enter the raw data into columns var1 and var2. Name the columns. If you have summarized data, follow the procedure for confidence intervals or hypothesis tests on a single mean with summarized data.
2. If you entered raw data, select Stat, highlight T Statistics, highlight Paired.
3. Highlight the column that contains sample 1 from the drop-down menu. Highlight the column that contains sample 2 from the drop-down menu. If you choose the hypothesis test radio button, enter the value of the mean stated in the null hypothesis and choose the direction of the alternative hypothesis from the drop-down menu. If you choose the confidence interval radio button, enter the level of confidence. Click Compute!.

Section 11.3 Inference about Two Means: Independent Samples

1. If necessary, enter the raw data into columns var1 and var2. Name the columns.
2. Select Stat, highlight T Statistics, highlight Two Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.
3. If you chose With Data, highlight the column that contains the data in the “Values in:” drop-down menu for Sample 1 and Sample 2. If you chose With Summary, enter the sample mean, sample standard deviation, and sample size for each sample. Uncheck the Pool variances box. If you choose the hypothesis test radio button, enter the value of the mean stated in the null hypothesis and choose the direction of the alternative hypothesis from the drop-down menu. If you choose the confidence interval radio button, enter the level of confidence. Click Compute!.

Section 11.4 Inference about Two Population Standard Deviations

1. If necessary, enter the raw data into columns var1 and var2. Name the columns.
2. Select Stat, highlight Variance Statistics, highlight Two Sample. Choose With Data if you have raw data, choose With Summary if you have summarized data.
3. If you chose With Data, highlight the column that contains the data in the “Values in:” drop-down menu for Sample 1 and Sample 2. If you chose With Summary, enter the sample variance and sample size for each sample. If you choose the hypothesis test radio button, enter the value of the ratio of the population variances stated in the null hypothesis and choose the direction of the alternative hypothesis from the drop-down menu. If you choose the confidence interval radio button, enter the level of confidence. Click Compute!.

Section 12.1 Goodness-of-Fit Test

1. Enter the observed counts in the first column. Enter the expected counts in the second column. Name the columns observed and expected.
2. Select Stat, highlight Goodness-of-fit, then highlight Chi-Square test.
3. Select the column that contains the observed counts and select the column that contains the expected counts. Click Compute!.

Section 12.2 Tests for Independence and the Homogeneity of Proportions

1. If the data are already in a contingency table, enter them into the spreadsheet. The first column is the row variable. For example, for the data in Table 5, the first column is level of happiness. Each subsequent column is the counts of each category of the column variable. For the data in Table 5, enter the counts for each marital status. Title each column (including the first column indicating the row variable). If the data are not in a contingency table, enter each variable in a column and name the column variable.

2. Select Stat, highlight Tables, highlight Contingency, then select With Data or With Summary.

3. If you chose With Data, select the column that contains the row variable and select the column that contains the column variable. If you chose With Summary, select the column variables. Then select the column that contains the row labels. Decide what values you want displayed. Choose the Chi-square test for independence under the Hypothesis tests menu. Click Compute!.

Section 13.1 Comparing Three or More Means (One-Way Analysis of Variance)

1. Either enter the raw data in separate columns for each sample or treatment, or enter the value of the variable in a single column with indicator variables for each sample or treatment in a second column.

2. Select Stat, highlight ANOVA, and select One Way.

3. If the raw data are in separate columns, select "Compare selected columns" and then click the columns you wish to compare. If the raw data are in a single column, the select "Compare values in a single column" and then choose the column that contains the value of the variables and the column that indicates the sample or treatment. Click Compute!.

Section 13.2 Post-Hoc Tests on One-Way Analysis of Variance

1. Repeat the steps for conducting a one-way analysis of variance. In Step 3, check the box "Compute Tukey HSD". Choose the level of confidence. Click Compute!.

Section 13.3 The Randomized Complete Block Design

1. In column var1, enter the block of the response variable; in column var2, enter the treatment of the response variable; and in column var3, enter the value of the response variable. Name the columns.

2. Select Stat, highlight ANOVA, and select Two Way.

3. Select the column containing the values of the response variable from the drop-down menu "Responses in:". Select the column containing the blocks from the drop-down menu "Row factor in:". Select the column containing the treatment in the drop-down menu "Column factor in:". Check the box "Fit additive model" Click Compute!.
Section 13.4 Two-Way Analysis of Variance

Obtaining Two-Way ANOVA & Interaction Plots

1. In column var1, enter the level of factor A; in column var2, enter the level of factor B; and in column var3, enter the value of the response variable. Name the columns.
2. Select Stat, highlight ANOVA, and select Two Way.
3. Select the column containing the values of the response variable from the drop-down menu "Responses in:". Select the column containing the row factor from the drop-down menu "Row factor in:". Select the column containing the column factor in the drop-down menu "Column factor in:". Check the box "Display means table" to use for Tukey's test. If you want interaction plots, check the "Plot interactions" box. Click Compute!.

Section 14.1 Testing the Significance of the Least-Squares Regression Model

Hypothesis Test on the Slope

1. Enter the explanatory variable in column var1 and the response variable in column var2. Name each column variable.
2. Select Stat, highlight Regression, and select Simple Linear.
3. Choose the explanatory variable for the X variable and the response variable for the Y variable. Select the Hypothesis tests radio button. Choose the appropriate values in the null hypothesis for both the intercept and slope. Choose the direction of the alternative hypothesis from the drop-down menu. Click Compute!.

Confidence Interval for the Slope

1. Enter the explanatory variable in column var1 and the response variable in column var2. Name each column variable.
2. Select Stat, highlight Regression, and select Simple Linear.
3. Choose the explanatory variable for the X variable and the response variable for the Y variable. Select the Confidence intervals radio button. Choose the confidence level. Click Compute!.

Section 14.2 Confidence and Prediction Intervals

1. If necessary, enter the explanatory variable in column var1 and the response variable in column var2. Name each column variable.
2. Select Stat, highlight Regression, and select Simple Linear.
3. Choose the explanatory variable for the X variable and the response variable for the Y variable. Enter a value of the explanatory variable to Predict Y for X. Enter the desired Prediction Level. Click Compute!.

Section 14.3 Multiple Regression

Correlation Matrix

1. Enter the explanatory variables and the response variable into the StatCrunch spreadsheet. Name each column variable.
2. Select Stat, highlight Summary Stats, highlight Correlation.
3. Click on the variables whose correlation you wish to determine from the "Select column(s) dialogue box. Click Compute!.

Determining the Multiple Regression Equation and Residual Plots

1. Enter the explanatory variables and the response variable into the StatCrunch spreadsheet. Name each column variable.
2. Select Stat, highlight Regression, and select Multiple Linear.
3. Choose the response variable for the Y variable and the explanatory variables for the X variables and any interactions (optional). Choose None for variable selection. Choose any options you wish. Click Compute!.

Section 15.3 Inferences about Measures of Central Tendency

1. Enter the raw data into column var1. Name the column.
2. Select Stat, highlight Nonparametrics, select Sign Test.
3. Select the variable from the Select Column(s): dialogue box. Enter the appropriate value of the median in the null hypothesis. Choose the correct alternative. Click Compute!.

Section 15.4 Inferences about the Difference between Two Medians: Dependent Samples

1. Enter the raw paired data into the first two columns. Name the columns. Determine the differenced data and enter it in the next column. Name the differenced data column.
2. Select Stat, highlight Nonparametrics, select Wilcoxon Signed Ranks.
3. Select the differenced data column from the Select Column(s): dialogue box. Enter the appropriate value of the median in the null hypothesis. Choose the correct alternative. Click Compute!.

Section 15.5 Inferences about the Difference between Two Medians: Independent Samples

1. Enter the raw data into the first two columns. Name the columns.
2. Select Stat, highlight Nonparametrics, select Mann-Whitney.
3. Choose the column for Sample 1 and the column for Sample 2. Enter the appropriate value of the median in the null hypothesis. Choose the correct alternative. Click Compute!.

Section 15.7 Kruskall-Wallis Test

1. Either enter the raw data in separate columns for each sample or treatment, or enter the value of the variable in a single column with indicator variables for each sample or treatment in a second column.
3. If the raw data are in separate columns, select "Compare selected columns" and then click the columns you wish to compare. If the raw data are in a single column, the select "Compare values in a single column" and then choose the column that contains the value of the variables and the column that indicates the sample or treatment. Click Compute!.