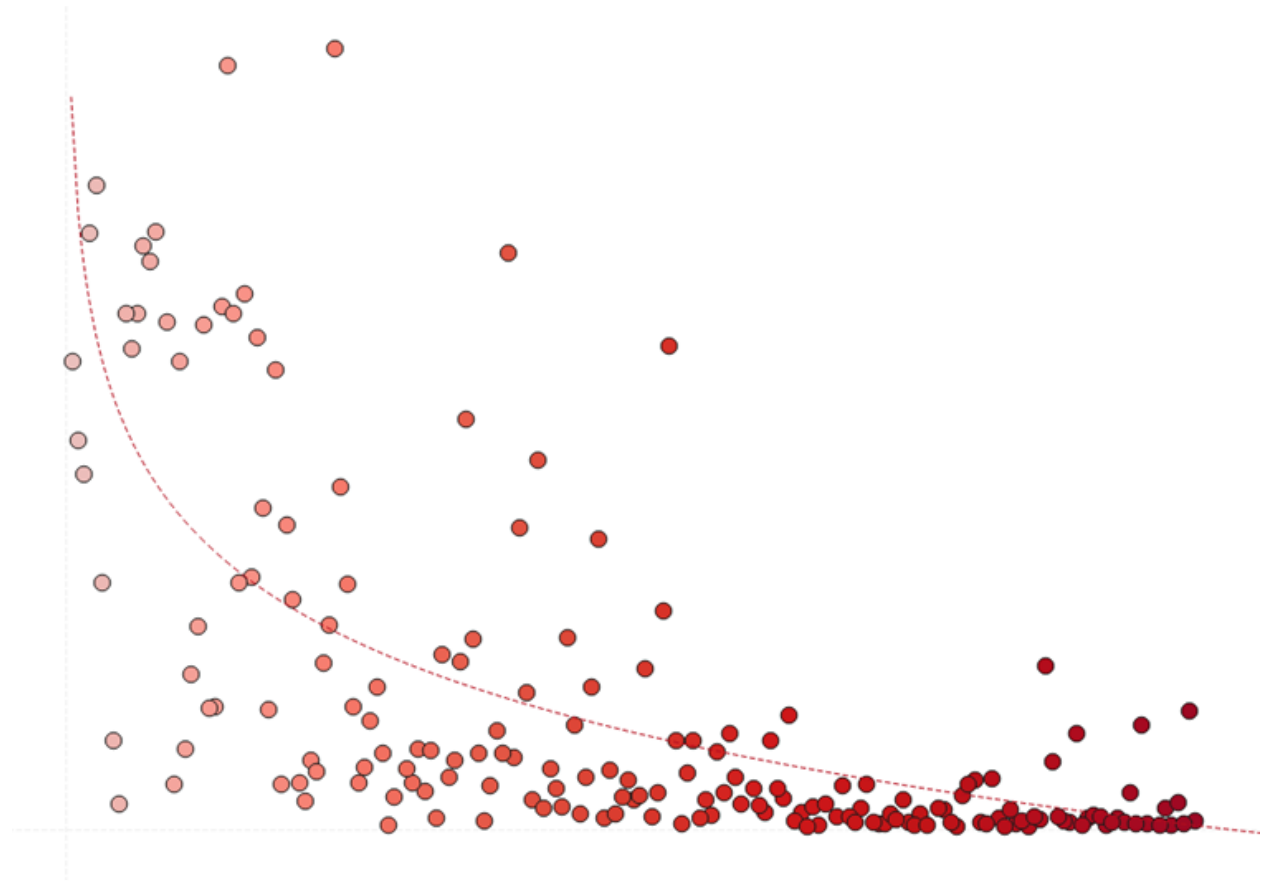


Tableau Classroom Training

Desktop III: Advanced

Practice Guide



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Version 2022.3

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How to Use These Materials

Each practice in this book supports and reinforces the skills presented in class. You won't be assigned to do a practice until the instructor has gone over the skills you need to complete it.

The practices include specifications on what you are to create or do in Tableau, often with a graphic of the finished view. (For a challenge, try to complete the practice using just the specification and the graphic as a guide.) This course also includes starter Tableau .twbx (packaged workbook) or data files to use with practices as well as completed solution files for all practices.

Practice Directions




Follow the general **Directions** included in each practice. These appear immediately after the graphic of the finished view. The steps might not include every menu item or mouse click, but they describe what you need to do to create the specified result.

If you need additional help, refer to the detailed **Solution** steps at the back of this book.

Student Files in the Practices Folder

The student **Practices** folder will be provided to you as a download link. The **Practices** folder contains the following:

- **Data** folder, containing the data sources used in the practices for this course. For some practices, you will need to connect to data sources in this folder.
- **Workbooks** folder, containing starter .twbx files for the practices in each module that uses them and completed solution files for each module.
- A brief feedback survey form, which we encourage you to complete at the end of training.

Name	Date modified	Type
 Data	9/28/2022 10:42 AM	File folder
 Workbooks	9/28/2022 10:42 AM	File folder
 Training Feedback Survey	9/28/2022 10:42 AM	URL File

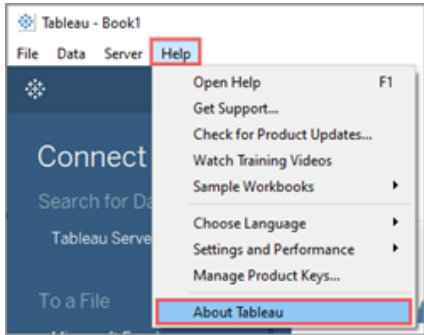

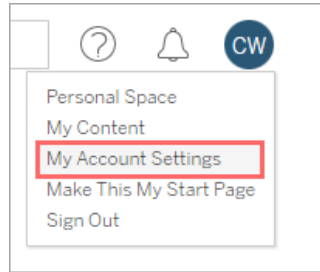
Browse to the starter and solution files: open the **Workbooks** folder, open either the **Starters** or **Solutions** subfolder, and then browse to the module subfolder and the specific starter or solution file you want to view.

NOTE If working with a download link of a zipped folder, right-click the folder and select **Extract All** to complete the download.

Selecting Your Environment

The activities for this course can be completed in the Tableau Desktop application or in the browser, from your Tableau site on Tableau Server or Tableau Cloud.

Refer to your course registration email or details from your instructor to select the tool based on your specific course. Most students will use Tableau Desktop. To ensure that you meet the requirements for the class, refer to the instructions for your environment in the following table.

Using Tableau Desktop:	Or Using a Tableau Site in the Browser:
<ul style="list-style-type: none"> You have downloaded the correct version of Tableau Desktop to your computer, as specified in your confirmation email. To verify the version, open Tableau Desktop, and from the Help menu, select About Tableau.  <ul style="list-style-type: none"> The version number is listed in at the top of the About Tableau window, to the left of the build number.  <ul style="list-style-type: none"> You have an active license. If you are using the free trial, note that it lasts for 14 days. 	<ul style="list-style-type: none"> You have a Creator license type and at least a Creator site role on a Tableau site. To verify your site role, log into your Tableau site and from the User menu at the top right of the screen, select My Account Settings.  <ul style="list-style-type: none"> Your site role is listed under your name at the top of the page. You have publishing permissions to a project on the site. NOTE If you are on a company Tableau site or a site owned by another user, we highly recommend that you request a Test project be created that you can use for storing files and completing activities. Alternatively, you can store files and complete activities in your Personal Space.

In the appendix at the back of this book, you can find detailed directions for accessing and saving the course materials from either the desktop application or the browser.

- "Working in the Desktop Application" on page 123
- "Working in the Browser" on page 127

For Mac Users

The instructions and images in this book were created using the Windows operating system, so people running Tableau Desktop using Mac OS may experience a few differences when doing the activities in the book.

Keyboard and Mouse Differences

Windows-based instruction	Difference on a Mac
CTRL + click	Press and hold the Command ⌘ key while you click.
Right-click	When using a mouse with no right-click button, press and hold the control key while you click.
Right-click and drag	Press the Option ⌥ (Alt) key, and hold it down while you click and drag.
Press CTRL	Press Command ⌘.
Press CTRL + Left Arrow	Press Command ⌘ + Control + Left Arrow

Visual Differences

The Windows-based instructions and images in this book may indicate that the X button to close a dialog box or window is in the top right corner, but on a Mac these buttons may be located in the top left corner instead.

There may also be small differences in the appearance and location of tabs, drop-down menus, and other visual features of Tableau Desktop, but the use and functionality of those features is the same in both operating systems.

Additional Note for Mac Users

When you open multiple workbooks in Tableau Desktop on a Mac, multiple instances of the application are created, each with its own icon in the Dock. This differs from typical Mac application behavior, where one instance of the application handles all open files managed by that application.

1. Review: Calculations

This module contains the following:

Practice: Review - String Calculation for Customer Names

Practice: Using a Date Calculation for a Dynamic Chart



Practice: Review - String Calculation for Customer Names

You want to create a view that shows **Sales** as text and groups customers alphabetically in rows by last name and first initial. Then, add a feature that allows users to select a letter and display the last names that start with that letter.

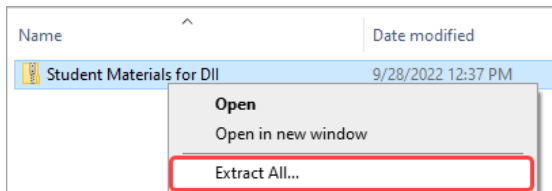
First Initial of Last Name	Last Name and First Initial	
E	Eason, B.	\$18,984
	Eaton, J.	\$21,905
	Edelman, K.	\$13,551
	Eichhorn, R.	\$16,339
	Elias, B.	\$18,412
	Elijah, J.	\$22,456
	Ellison, J.	\$19,728
	Ellison, M.	\$10,708
	Elliston, L.	\$11,479
	Emerson, R.	\$14,040
	Engle, H.	\$10,994
	Engle, M.	\$9,924
	Engle, S.	\$30,146
	Eno, D.	\$12,800
	Eplett, B.	\$28,479
	Epp, J.	\$13,950
	Etezadi, M.	\$26,247

First Initial of Last Name

- ☐ (All)
☐ A
☐ B
☐ C
☐ D
☒ E
☐ F
☐ G
☐ H
☐ I
☐ J
☐ K
☐ L
☐ M
☐ N
☐ O
☐ P
☐ R
☐ S
☐ T
☐ U
☐ V
☐ W
☐ Y
☐ Z

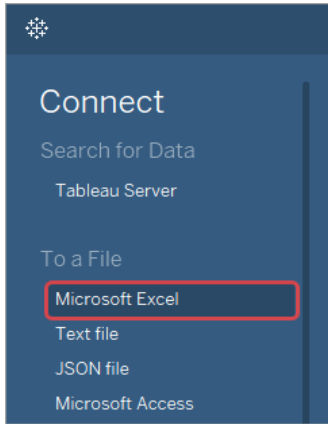
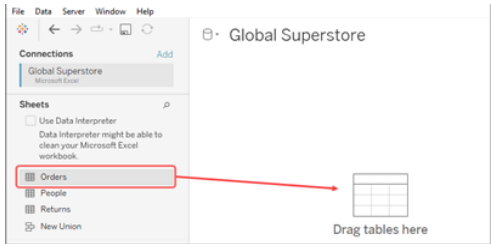
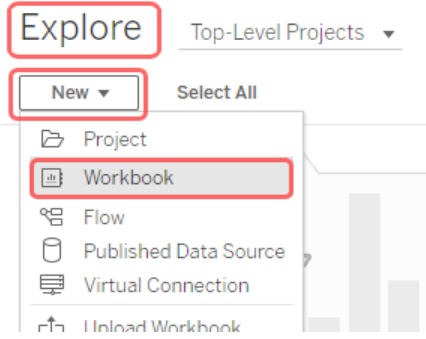
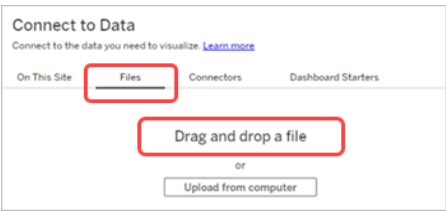
Connect to Data

- To begin, if you're working with a download link of a zipped **Materials** folder, right-click the folder and select **Extract All** to download the files if you have not previously done so.



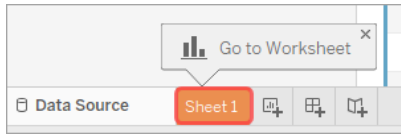
2. **IMPORTANT** You will now create the connection from either the Tableau Desktop application or from your browser-based site on Tableau Cloud or Tableau Server. The following table contains both sets of instructions for creating the connection.

- For **Tableau Desktop**, follow the instructions "Connect to Data from Tableau Desktop".
- For a browser-based site on **Tableau Cloud or Tableau Server**, follow the instructions "Connect to Data from the Browser".

Connect to Data from Tableau Desktop:	Or Connect to Data from the Browser:
<ol style="list-style-type: none"> 1. Open Tableau Desktop, and under Connect click Microsoft Excel.  <ol style="list-style-type: none"> 2. In the dialog box that opens, browse to the Global Superstore.xlsx data source, located in the Data folder within the Practices folder of Student Materials and click Open. 3. On the Data Source tab, in the Connections pane, under Sheets, double-click the Orders table to add it to the canvas, or drag and drop it to the Drag tables here area on the canvas.  <ol style="list-style-type: none"> 4. Click Sheet 1 to go to the 	<ol style="list-style-type: none"> 1. In the Student Materials folder, open the Data subfolder. 2. On the Explore page of your Tableau site, click New and then click Workbook.  <ol style="list-style-type: none"> 3. In the Connect to Data dialog box, select the Files tab. 4. From the Data subfolder of the Student Materials folder, drag Global Superstore.xlsx to the Connect to Data dialog box, and drop on Drag and drop a file.  <ol style="list-style-type: none"> 5. On the Data Source tab, in the Connections pane, under Sheets, double-click the Orders table to add it to the canvas, or drag and drop it to the Drag tables here area on the

Connect to Data from Tableau Desktop:

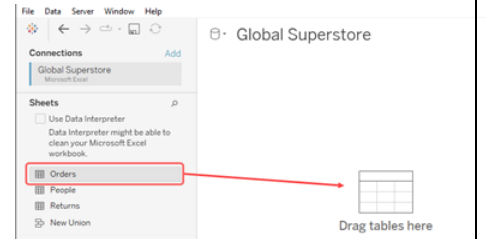
worksheet.



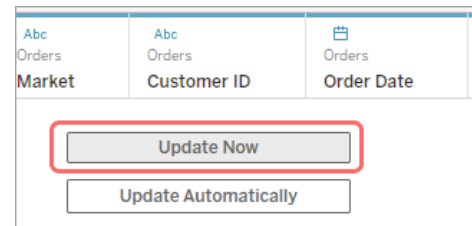
- Continue to the section "Create Calculated Fields and Build a View".

Or Connect to Data from the Browser:

canvas.



- In the data grid, click **Update Now** to populate it.



- Select the **Sheet 1** tab to open a new worksheet.
- Continue to the section "Create Calculated Fields and Build a View".

Create Calculated Fields and Build a View

- Create a calculated field, using the **Customer Name** field, to organize the customers by last name initial, and name it "First Initial of Last Name".

To make this calculated field you'll need two functions:

- A function that finds the position of the space separating the first name from the last name; this position, plus one, gives the starting position of the last name.
- Another function that uses that middle starting position, with a substring of length one, to return the first initial of the last name.

TIP In the Calculation Editor, open the functions reference (click the triangle icon on the right side of the Calculation Editor). Each function includes syntax, a description, and an example for your reference.

- Create another calculated field, again using the **Customer Name** field, to show the last name and first initial, and name it "Last Name and First Initial".

To make this calculated field you'll need three functions:

- A function that finds the position of the space separating the first name from the last name.
- Another function that uses that middle starting position of the last name, this time without an optional length argument, in order to return the entire last name.

- A function that returns the first initial of the first name and a period, and then concatenates the last name with a comma and a space to the first initial of the first name.
- 3. Create a view using these fields, with **First Initial of Last Name** and **Last Name and First Initial** on **Rows**, and **Sales** on **Text**.
- 4. Format **Sales** as currency with zero decimal places.
- 5. Create a filter using **First Initial of Last Name**, set as a single value list.

SELF CHECK How many customer last names start with Y?

Bonus Activity

Group customer last names as follows: A-E, F-J, K-O, P-T, U-Z.

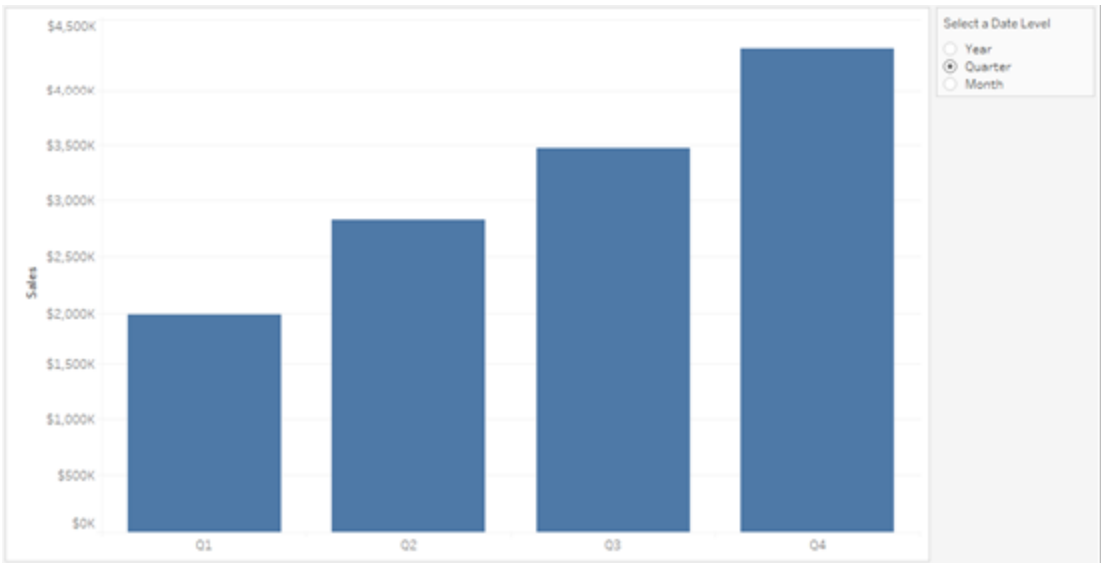
Solution

For the solution to this practice, see "Solution: Review - String Calculation for Customer Names" on page 67.



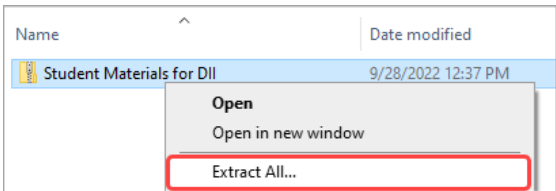
Practice: Using a Date Calculation for a Dynamic Chart

You're interested in tracking your aggregated sales and would like to see which quarter's sales were highest. Create a view that aggregates sales by quarter. Then, create a parameter that allows users to review sales in each quarter.



Connect to Data

1. To begin, if you're working with a download link of a zipped **Materials** folder, right-click the folder and select **Extract All** to download the files if you have not previously done so.

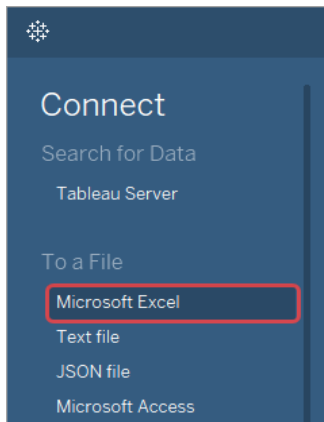


2. **IMPORTANT** You will now create the connection from either the Tableau Desktop application or from your browser-based site on Tableau Cloud or Tableau Server. The following table contains both sets of instructions for creating the connection.
 - For **Tableau Desktop**, follow the instructions "Connect to Data from Tableau Desktop".
 - For a browser-based site on **Tableau Cloud or Tableau Server**, follow the instructions "Connect to Data from the Browser".

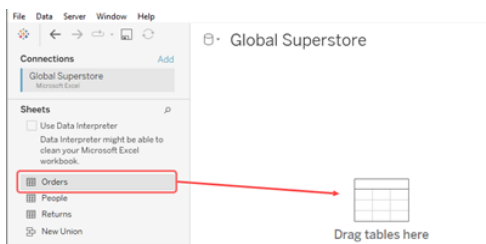
Connect to Data from Tableau Desktop:	Or Connect to Data from the Browser:
1. Open Tableau Desktop, and under	1. In the Student Materials folder,

Connect to Data from Tableau Desktop:

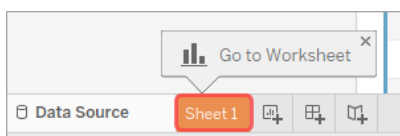
Connect click **Microsoft Excel**.



- In the dialog box that opens, browse to the **Global Superstore.xlsx** data source, located in the **Data** folder within the **Practices** folder of **Student Materials** and click **Open**.
- On the **Data Source** tab, in the **Connections** pane, under **Sheets**, double-click the **Orders** table to add it to the canvas, or drag and drop it to the **Drag tables here** area on the canvas.



- Click **Sheet 1** to go to the worksheet.

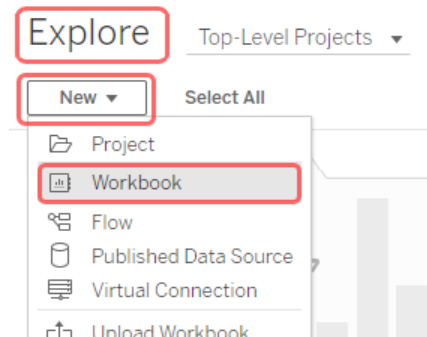


- Continue to the section "Create a Parameter and Build a View".

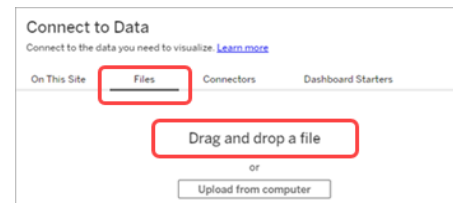
Or Connect to Data from the Browser:

open the **Data** subfolder.

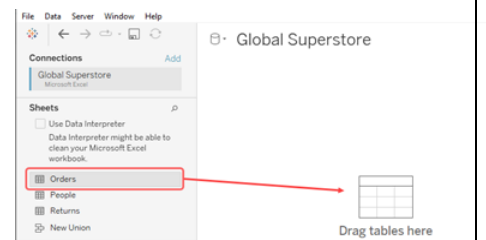
- On the **Explore** page of your Tableau site, click **New** and then click **Workbook**.



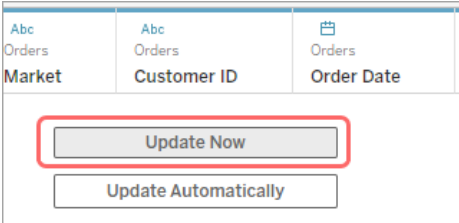
- In the **Connect to Data** dialog box, select the **Files** tab.
- From the **Data** subfolder of the **Student Materials** folder, drag **Global Superstore.xlsx** to the **Connect to Data** dialog box, and drop on **Drag and drop a file**.



- On the **Data Source** tab, in the **Connections** pane, under **Sheets**, double-click the **Orders** table to add it to the canvas, or drag and drop it to the **Drag tables here** area on the canvas.



- In the data grid, click **Update Now**

Connect to Data from Tableau Desktop:	Or Connect to Data from the Browser:
	<p>to populate it.</p> 
	<ol style="list-style-type: none"> 7. Select the Sheet 1 tab to open a new worksheet. 8. Continue to the section "Create a Parameter and Build a View".

Create a Parameter and Build a View

1. Create a parameter named "Select a Date Level" with the **Data type** of **String** and the **List of Values**: "Year", "Quarter", and "Month".
2. Create a calculated field named "Date Level Calculation" using the **Order Date** field to display the date based on the parameter value:

```

CASE[Select a Date Level]
WHEN 'Year' THEN DATENAME('year', [Order Date])
WHEN 'Quarter' THEN DATENAME('quarter', [Order Date])
WHEN 'Month' THEN DATENAME('month', [Order Date])
END

```
3. Create the view: drag **Sales** to **Rows** and **Date Level Calculation** to **Columns**.
4. Show the parameter control as a single value list.
5. Edit the alias names for the quarters to: "Q1", "Q2", "Q3", and "Q4".
6. **Tableau Desktop only**: Hide the field label for **Date Level Calculation** from the view.

SELF CHECK Does each date level show the same pattern of growth of **Sales**?

Solution

For the solution to this practice, see "Solution: Using a Date Calculation for a Dynamic Chart" on page 71.

2. Advanced Table Calculations

This module contains the following:

Practice: Review - Secondary Table Calculations

Practice: Using Specific Dimensions

Practice: Customizing Table Calculations

Practice: Difference from Average

Practice: Weighted Average Sales

Practice: Filtering Table Calculations

Practice: Pareto Chart



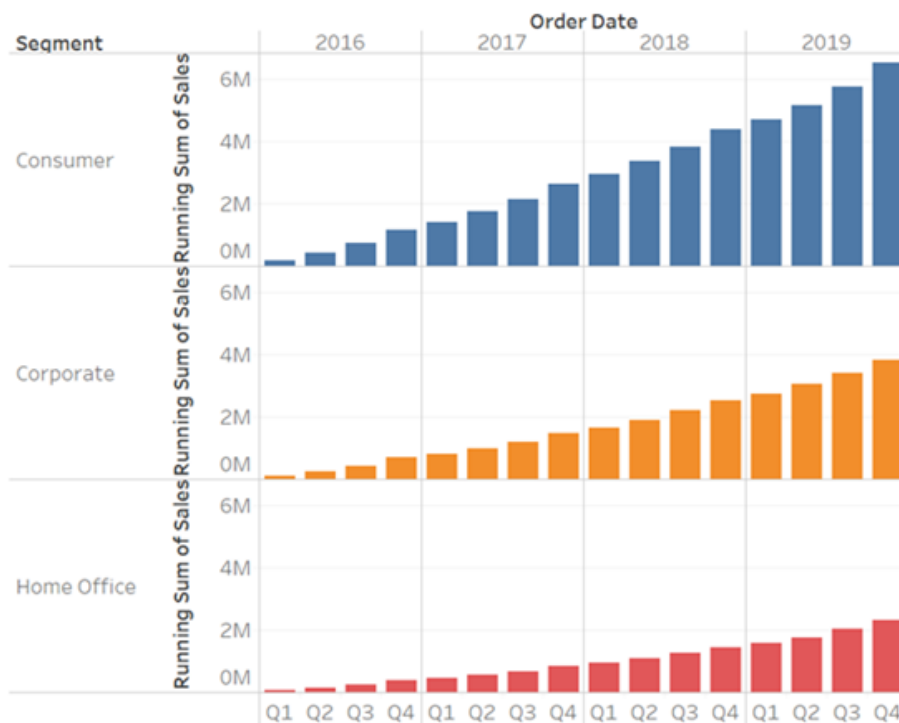
Practice: Review - Secondary Table Calculations

You want to see how sales from customer segments have grown or shrunk in importance to the company over time.

First, create a view that uses a table calculation to compute the running sum of sales by segment over time. Then, duplicate the view and use a secondary table calculation to show cumulative product sales by segment as a percent of total sales.

View 1: Cumulative Sales by Segment

- Show the cumulative product sales by segment.



Directions

- Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
- Use the **Orders** sheet for your analysis.
- Name the worksheet "Running Total" and build the initial view:
 - From the **Data** pane:
 - Drag **Sales** to **Rows**.
 - Drag **Segment** to **Rows**, to the left of **Sales**.
 - Drag **Order Date** to **Columns**.
- Expand **YEAR(Order Date)** to also show **QUARTER(Order Date)**.
- Change the chart type to **Bar**.
- Drag another copy of **Segment** from the **Data** pane to **Color**.

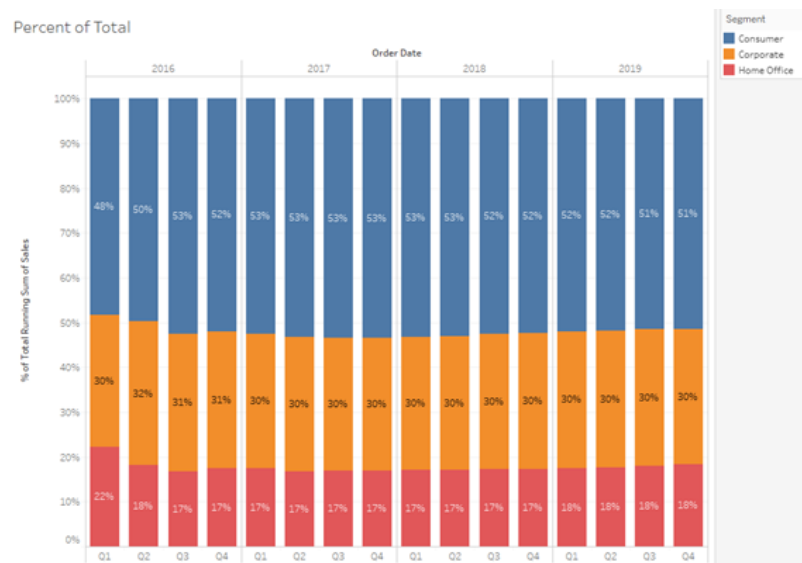
- On the **Rows** shelf, click the drop-down menu on **SUM(Sales)**, select **△Add Table Calculation**.
- In the **Table Calculation** dialog box, click the drop-down menu for **Calculation Type** and select **Running Total**. Note that the **Compute Using** option defaults to **Table (across)** which is what we want.

SELF CHECK 1 What are the cumulative sales for the consumer segment as of the end of 2018?

SELF CHECK 2 What secondary table calculation could we use to determine whether sales from a customer segment have grown or shrunk in importance to the company over time?

View 2: Percent of Total Sales

- Duplicate the first worksheet, and add a secondary table calculation to show the cumulative product sales by segment as a percent of total sales.
- Show as a stacked bar chart.



Directions

- Duplicate the sheet **Running Total** and name the new sheet "Percent of Total".
- On **SUM(Sales)** △, add a **Percent of Total** secondary table calculation using **Table (down)**.
- Change the view to a stacked bar chart. (**HINT**: What dimension is the view currently sliced by?)
- CTRL+drag **SUM(Sales)** △ from **Rows** to **Label**.
- Format **SUM(Sales)** △ to be a percentage with zero (0) decimal places.

SELF CHECK 3 Why does the secondary table calculation use Table (down) as its scope and direction instead of using Table (across)?

Solution

For the solution to this practice, see "Solution: Review - Secondary Table Calculations" on page 73.



Practice: Using Specific Dimensions

State	Year of Order Date	Rank of Sales along State	Sales
Alabama	2016	18	\$6,139
	2017	30	\$3,892
	2018	20	\$7,651
	2019	37	\$1,828
Arizona	2016	13	\$8,295
	2017	12	\$9,611
	2018	21	\$6,242
	2019	16	\$11,134
Arkansas	2016	16	\$6,303
	2017	42	\$444
	2018	33	\$2,224
	2019	35	\$2,708

View One: Crosstab

You want to know the yearly sales for each state, and where each state ranks in annual sales.

Directions

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Name the worksheet "Rank of States by Sales and Year".
4. Drag **Sales** from the **Data** pane to **Text** on the **Marks** card.
5. Filter by the **United States**.
6. Drag **State** to **Rows**.
7. Add a table calculation for **SUM(Sales)** to calculate the **Rank** for each state's sales.
8. Drag **Sales** from the **Data** pane to the view.
9. Drag **Order Date** from the **Data** pane to **Rows** to the right of **State**. Note what happened to the **Rank**. It is being calculated for **Sales** of each **Year of Order Date** by **State**. Instead, we want the rank to be calculated for each year separately.
10. Open the **Table Calculation** dialog box to edit the table calculation for **SUM(Sales)** △.
11. Click **Specific Dimensions** in the **Compute Using** options.
12. Clear the **Year of Order Date** check box.
13. Make sure the **State** check box is selected.

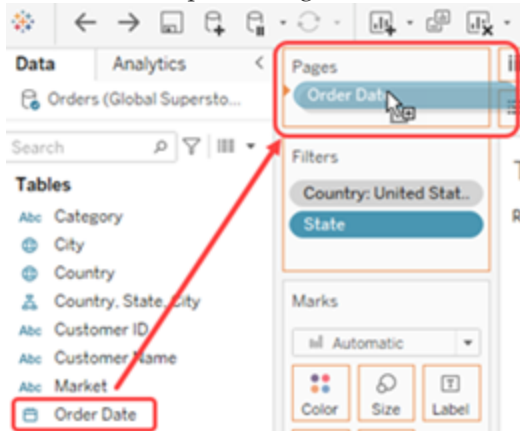
SELF CHECK 1 Which state has ranked first in total sales for all four years?

View Two: Animated Bar Chart

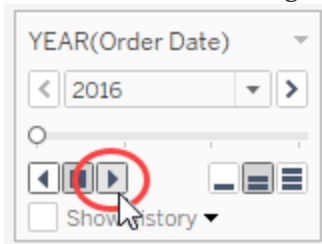
Now you would like to display the top 20 states by sales, ranked by sales per year, in an animated bar chart.

1. Create a new worksheet and name it "Top 20 States Ranked by Sales".
2. Filter by the United States.

3. Drag **Sales** to **Columns**.
4. Drag **State** to **Label** on the **Marks** card.
5. Drag **State** to **Color** on the **Marks** card.
6. Add a filter for top 20 **States** by **Sales**.
7. Add the **Country** filter to context.
8. Drag another instance of **Sales** to **Rows**, right-click, and select **Add Table Calculation**. This calculation will rank states from highest sales to lowest.
 - **Calculation Type:** Rank, Descending, Unique
 - **Compute Using:** Specific Dimensions, State
9. On **Rows**, convert **SUM(Sales)** Δ to **Discrete**.
10. Set the view to **Fit Height**.
11. From the **Data** pane, drag **Order Date** to the **Pages** shelf.



12. Use the **Format** menu to open the **Animations** pane.
13. In the **Animations** pane, under **Selected Sheet**, select **On**, **1.00 seconds (Slow)**, and **Simultaneous (Default)**, and then close the **Animations** pane.
14. At the bottom of the **Pages** card, click the **Play** button to activate the animation.



SELF CHECK 2 Which state has seen its sales ranking change from 5 to 4 to 10 to 3 over time?

Solution

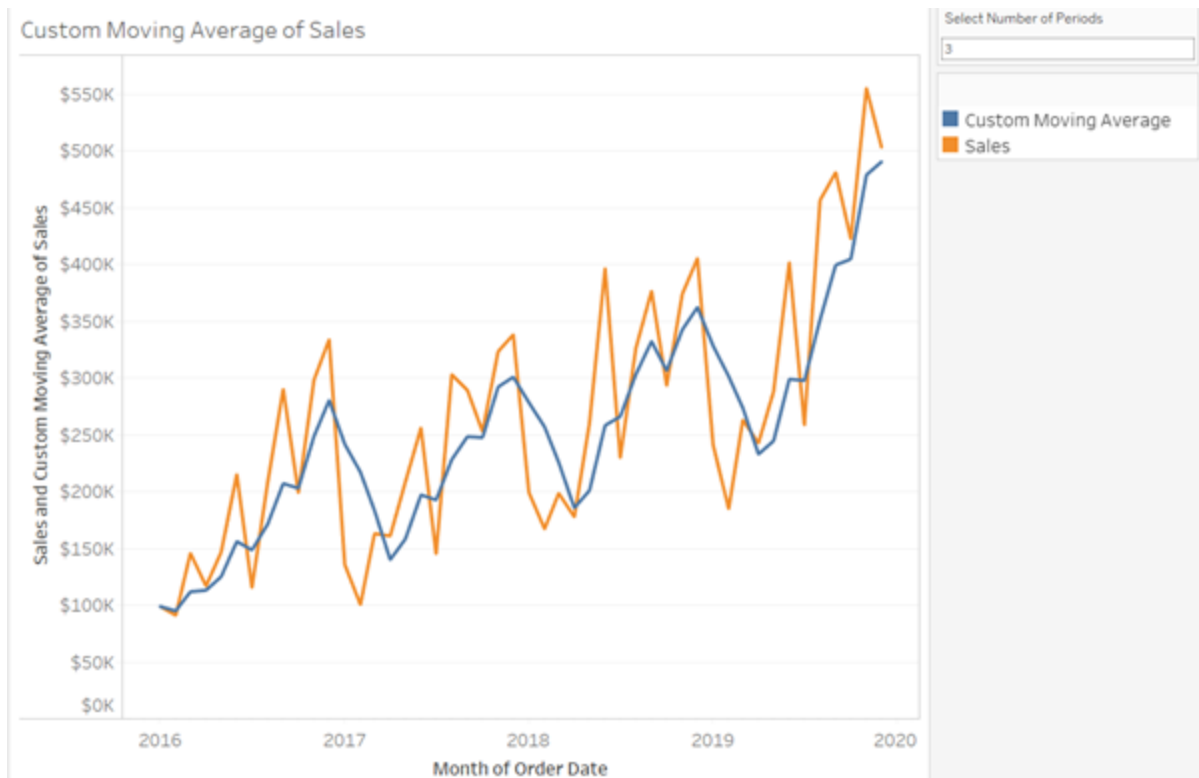
For the solution to this practice, see "Solution: Using Specific Dimensions" on page 75.



Practice: Customizing Table Calculations

Customizing a table calculation allows the user control over values used in the computation. In this practice, you will customize a moving average using a parameter for the number of periods to use in the average.

First, create a synchronized dual-axis line chart across continuous months that shows the sum of sales and a moving average of sales. Then add an integer parameter that the user can set to select the number of previous periods over which to calculate the moving average of sales displayed.



Directions

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Drag **Sales** to **Rows**, and **Order Date** to **Columns**.
4. Right-click **Order Date** and select the **Month** date value (May 2015) format.
5. Drag a second copy of **Sales** to the right of the first copy on **Rows**, and then edit it by adding a **Moving Calculation** table calculation that is set to **Average** (other values at defaults).
6. Create a new integer parameter named "Select Number of Periods", and show the parameter control.
7. From **Rows**, CTRL+click and drag the second instance of **SUM(Sales)** Δ (the one with the Table Calculation applied), and drop it on the **Data pane** to create a new calculated field.
8. Name the new calculated field "Custom Moving Average".

9. Edit the calculated field to use the parameter in place of the existing value "2" (leave the negative sign as is). Ensure that **Custom Moving Average** is used in the view.
10. Set the view to **Dual Axis** (**HINT**: Right-click **Custom Moving Average** Δ on **Rows**), synchronize the axes, hide the right axis header, and rename the left axis header to "Sales and Custom Moving Average of Sales".)
11. Hide the **Measure Names** legend title.
12. Test the parameter control by typing in different numbers for **Select Number of Periods**.

SELF CHECK 1 For the moving average of sales on a semi-annual basis (number of periods = 6), which month typically has the lowest sales average?

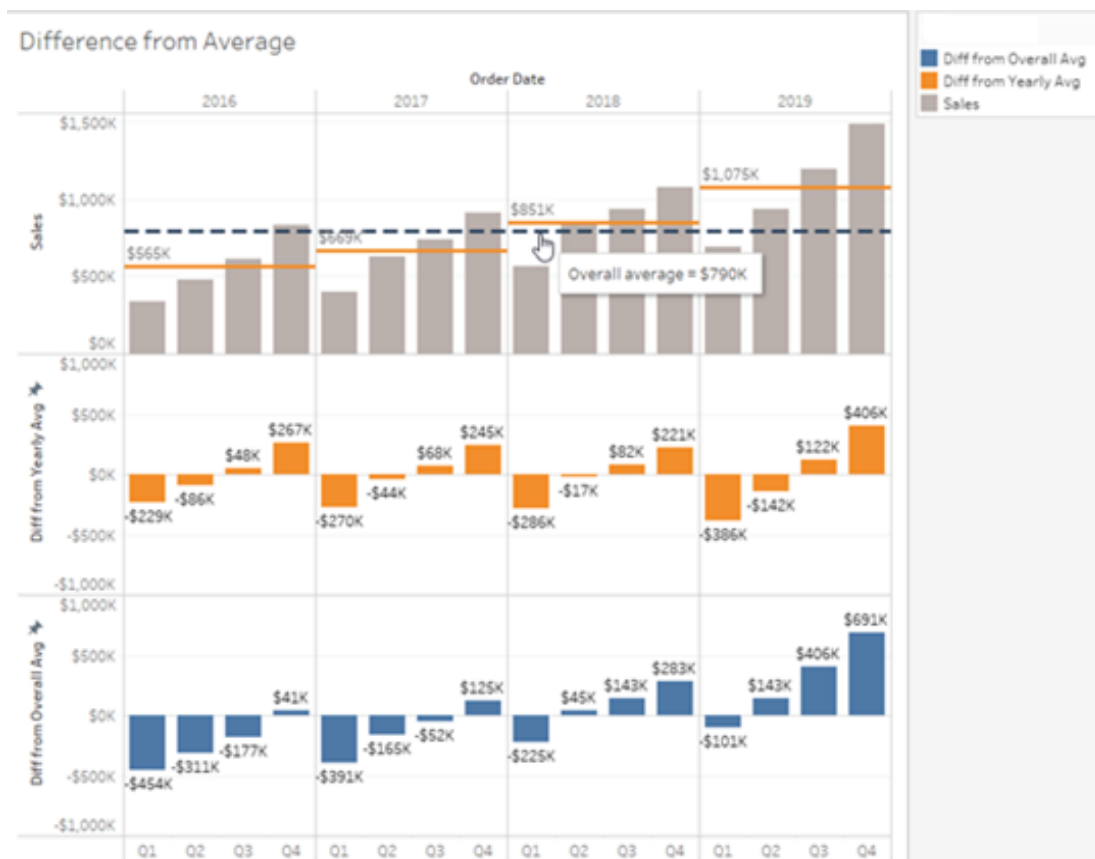
Solution

For the solution to this practice, see "Solution: Customizing Table Calculations" on page 77.



Practice: Difference from Average

You would like to compare actual quarterly sales versus average yearly and overall sales. To do so, you will create a bar chart, customize table calculations, and add reference lines to your view.



Create the Initial View

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Drag **Sales** to **Rows** and **Order Date** to **Columns**.
4. Expand **YEAR(Order Date)** so that **QUARTER(Order Date)** is also on **Columns**.
5. Change the chart type to **Bar**.
6. From the **Data** pane, drag another copy of **Sales** to **Rows**.
7. From the second **SUM(Sales)** on **Rows**, add a table calculation with a **Calculation Type** of **Moving Calculation** that uses **Average** to summarize the value with a scope and direction of **Pane (across)**.

Customize the First Table Calculation

Customize the first table calculation to compute the difference between the actual quarterly sales and the average sales for that year.

1. From **Rows**, CTRL + drag **SUM(Sales)** △ (the field with the table calculation applied) to the **Data** pane. This will create a new calculated field from the table calculation that you can customize.
2. Name the new calculated field "Diff from Yearly Avg".
3. From the **Data** pane, right-click the **Diff from Yearly Avg** calculated field and select **Edit**.
4. Change the formula to:
`SUM([Sales]) - WINDOW_AVG(SUM([Sales]), FIRST(), LAST())`
5. Ensure that **Diff from Yearly Avg** is used in the view and that it computes using **Pane (across)**.

Create the Second Table Calculation

1. From the **Data** pane, drag another copy of **Sales** to **Rows**, to the right of **Diff from Yearly Avg** △.
2. On **Rows**, right-click the newly-added **SUM(Sales)** and select **Add Table Calculation** with a **Calculation Type** of **Moving Calculation** that uses **Average** to summarize the value with a scope and direction of **Table (across)**.

Customize the Second Table Calculation

Customize the second table calculation to compute the difference between the actual quarterly sales and the overall average sales.

1. From **Rows**, CTRL + drag **SUM(Sales)** △ (the field with the new table calculation applied) to the **Data** pane. This will create another new calculated field that you can customize.
2. Name the new calculated field "Diff from Overall Avg".
3. From the **Data** pane, right-click the **Diff from Overall Avg** calculated field and select **Edit**.
4. Change the formula to:
`SUM([Sales]) - WINDOW_AVG(SUM([Sales]))`
5. Ensure that **Diff from Overall Avg** is used in the view.

Format the View

1. Change the **Number format** for **Sales** and for the two calculated fields to use **Currency (Custom)** with **Units in Thousands (K)** format, and **Negative values** set to **-\$1234**.
2. Expand **All** on the **Marks** card, and then drag **Measure Names** to **Color**.
3. Change the color of the **Sales** bar chart to gray, and confirm that the **Diff from Yearly Avg** chart is orange, and the **Diff from Overall Avg** chart is blue.

4. Hide the title of the color legend.
5. Click **Diff from Yearly Avg** on the **Marks** card, and show mark labels.
6. Do the same for **Diff from Overall Avg** on the **Marks** card.
7. On the top bar chart, for **Sales**, add a reference line to show the **Average SUM(Sales) Per Pane** with a label showing the value and a customized tooltip that states "Yearly average = " and the value.
Tableau Desktop only: Use a solid orange line.
8. On the same bar chart, add another reference line to show the **Average SUM(Sales)** for the **Entire Table** with no label and a customized tooltip that states "Overall average = " and the value. **Tableau Desktop only:** Use a dashed blue line.
9. Edit the vertical axis for both of the difference charts to show the difference from actual sales as follows:
 - **Fixed start** of -1,000,000
 - **Fixed end** of 1,000,000

SELF CHECK 1 What pattern(s) do you see in the difference between the actual quarterly sales and the yearly and overall averages?

SELF CHECK 2 Why include the **FIRST()** and **LAST()** arguments? Are they necessary?

Solution

For the solution to this practice, see "Solution: Difference from Average" on page 79.



Practice: Weighted Average Sales

You're interested to learn how product sales vary across sub-categories. Also, you would like to investigate whether some of the company's products have high sales amounts but low actual sales.

Create a view that shows average sales by sub-category. Then, calculate a weighing factor based on the quantity ordered for each product versus the quantity ordered for all products. Finally, calculate and show the weighted average sales for each product sub-category.

Weighted Averages



Directions

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. On the **Weighted Averages** tab, build the initial view:

Drag this	To
Sales	Columns
Sub-Category	Rows

4. Change the aggregation of **Sales** to **Average**.
5. Create a calculated field named "Weighting Factor by Quantity", defined as:

$$\text{SUM}([\text{Quantity}]) / \text{WINDOW_SUM}(\text{SUM}([\text{Quantity}]), \text{FIRST}(), \text{LAST}())$$

This customized table calculation will compute a weighting factor comparing the quantity ordered for each product with the quantity ordered for all of the product sub-categories.
6. Create another calculated field named "Weighted Average Sales", defined as:

$$\text{AVG}([\text{Sales}]) * [\text{Weighting Factor by Quantity}]$$
7. Add **Weighted Average Sales** to **Columns** in the view.
8. From the **Data** pane, drag **Measure Names** to **Color** on the **Marks** card.

SELF CHECK 1 Compare the weighted and unweighted average sales of tables. Why are the relative bar lengths so different?

SELF CHECK 2 Compare the weighted and unweighted average sales of phones. Why are those relative bar lengths so different?

SELF CHECK 3 Why include **FIRST()** and **LAST()** arguments? Are they required?

Solution

For the solution to this practice, see "Solution: Weighted Average Sales" on page 84.



Practice: Filtering Table Calculations

You currently have two visualizations. The **Sales** tab shows actual sales by quarter and business unit, indicating that they have been generally increasing overall. The second visualization, on the **Difference in Sales** tab, shows how much sales values went up or down each quarter throughout the year. Now, you would like to add a filter to the view so you can specify which quarters you would like to see. To do this, you will create a table calculation filter to show sales differences and totals for selected quarters.

View 1: Filtered Table Calculations

Difference in Sales

Business Unit		Quarter		
		Q2	Q3	Q4
Consumer	Sales	30,718	27,635	51,348
	Difference in Sales ..	21,548	-3,083	23,713
Enterprise	Sales	18,354	35,691	48,745
	Difference in Sales ..	3,105	17,337	13,054

Directions

- Open **Filter Table Calculations Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
 - For specific instructions for opening a .twbx file in Tableau Desktop, see "Working in the Desktop Application" on page 123
 - "Working in the Browser" on page 127
- On the **Difference in Sales** tab, show a filter for **Quarter** in the view.
- Exclude the data from the first quarter in the view.

SELF CHECK 1 Why is the **Difference in Sales** from the previous quarter blank in the **Q2** column?

- Show the first quarter data again in the view.
- Create a calculated field named "Quarter Table Calculation Filter" using the **Quarter** field and the **LOOKUP** table calculation function:

LOOKUP (MIN ([Quarter]), 0)

6. Show the **Quarter Table Calculation Filter** as a filter in the view.
7. Use the **Quarter Table Calculation Filter** to exclude **Q1** from the view.

SELF CHECK 2 Why is the **Difference in Sales** from the previous quarter now showing in the **Q2** column?

View 2: Filtered Totals

Now you would like to add totals to the view that will also be filtered by the table calculation filter.

- Show totals by **Quarter**.
- Adjust the table calculation filter to also apply to the totals.

Filtered Totals

Business Unit		Quarter	
		Q3	Q4
Consumer	Sales	27,635	51,348
	Difference in Sales ..	-3,083	23,713
Enterprise	Sales	35,691	48,745
	Difference in Sales ..	17,337	13,054
Grand Total	Sales	63,326	100,093
	Difference in Sales ..	14,254	36,767

Directions

1. Duplicate the **Difference in Sales** tab and name the new sheet "Filtered Totals".
2. On the **Filtered Totals** worksheet, show grand totals by quarter.
3. Include the totals in the color encoding for both **SUM(Sales)** and **Difference in SUM(Sales)**.
4. Use the **Quarter Table Calculation Filter** to exclude **Q1** and **Q2** from the view.

SELF CHECK 3 Why are the totals still showing in the view for **Q1** and **Q2**?

5. On the **Quarter Table Calculation Filter** on the **Filters** shelf, apply the filter to the totals in the view.

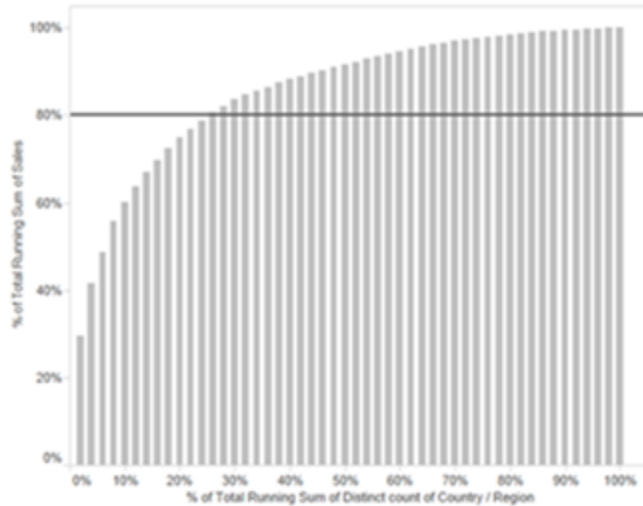
Solution

For the solution to this practice, see "Solution: Filtering Table Calculations" on page 85.



Practice: Pareto Chart

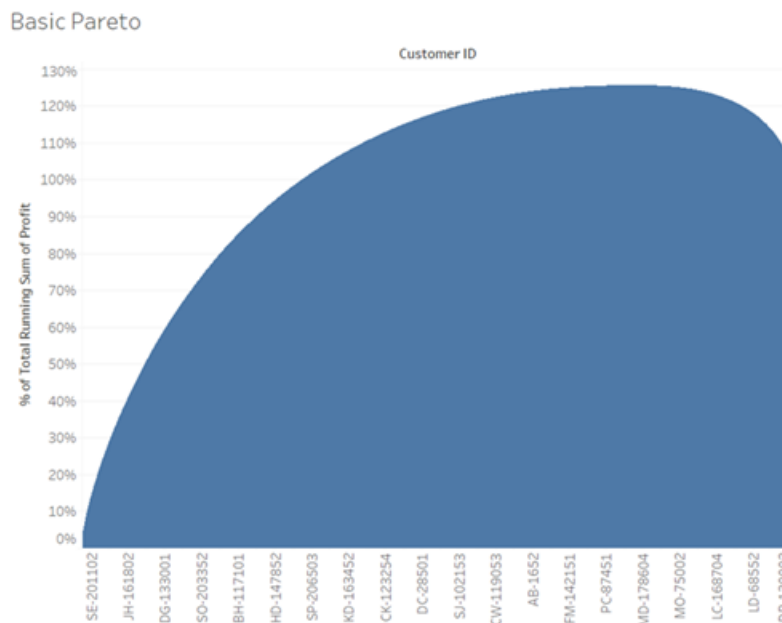
The Pareto chart is named after Vilfredo Pareto, a 19th century economist. The Pareto principle states that, for many events, roughly 80% of the effects come from 20% of the causes. This is also known as the 80-20 rule.



For this practice, you want to create three different views that build on one another to arrive at a complete Pareto chart.

First, show **Customer ID** sorted in descending order by **Profit**. Then, use a **Running Total** table calculation on **Profit**, defined as summarized using **Sum** and along **Customer ID**. Finally, use a secondary calculation for **Percent of Total** summarized along **Customer ID**.

Part 1: Basic Pareto

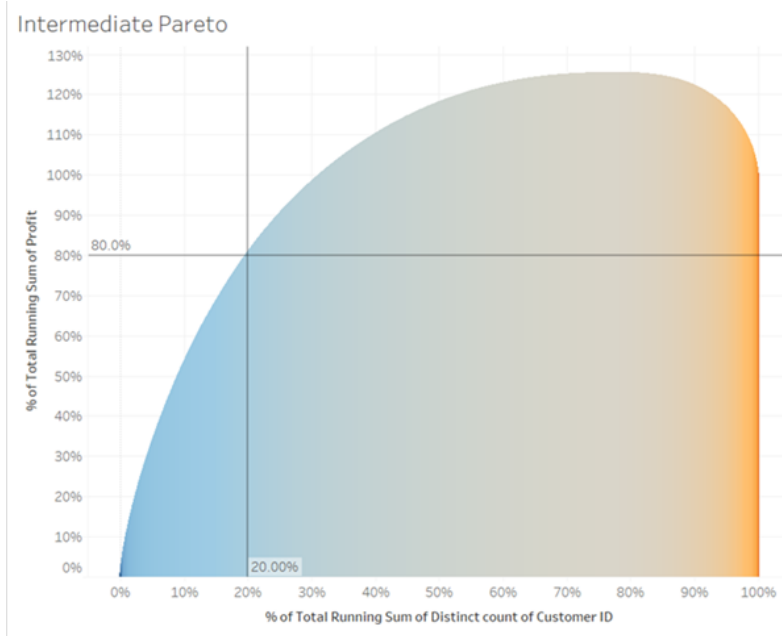


Directions

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Name the worksheet **Basic Pareto**.
4. Build the initial view:
 - Drag **Profit** to **Rows**
 - Drag **Customer ID** to **Columns**
 - Right-click on **Customer ID** on **Columns** and sort descending order by **Sum of Profit**
 - Change the window fit from **Standard** to **Entire View**
5. On **Rows**, right-click **SUM(Profit)**, and choose **Add Table Calculation**.
 - **Calculation Type:** Running Total, Sum
 - **Compute Using:** Specific Dimensions, ensure **Customer ID** is checked
 - Select **Add secondary calculation**
 - **Secondary Calculation Type:** Percent of Total
 - **Compute Using:** Specific Dimensions, ensure **Customer ID** is checked

Part 2: Intermediate Pareto

In a duplicate view of **Basic Pareto**, show **Customer ID** as a **Count (Distinct)** measure. Then, add a **Running Total** table calculation to **Customer ID** (on **Columns**) using **Sum**, with a secondary calculation using **Percent of Total**, both summarized using **Customer ID**. Finally, format the view and add reference lines to show 80% of profits and 20% of customers.

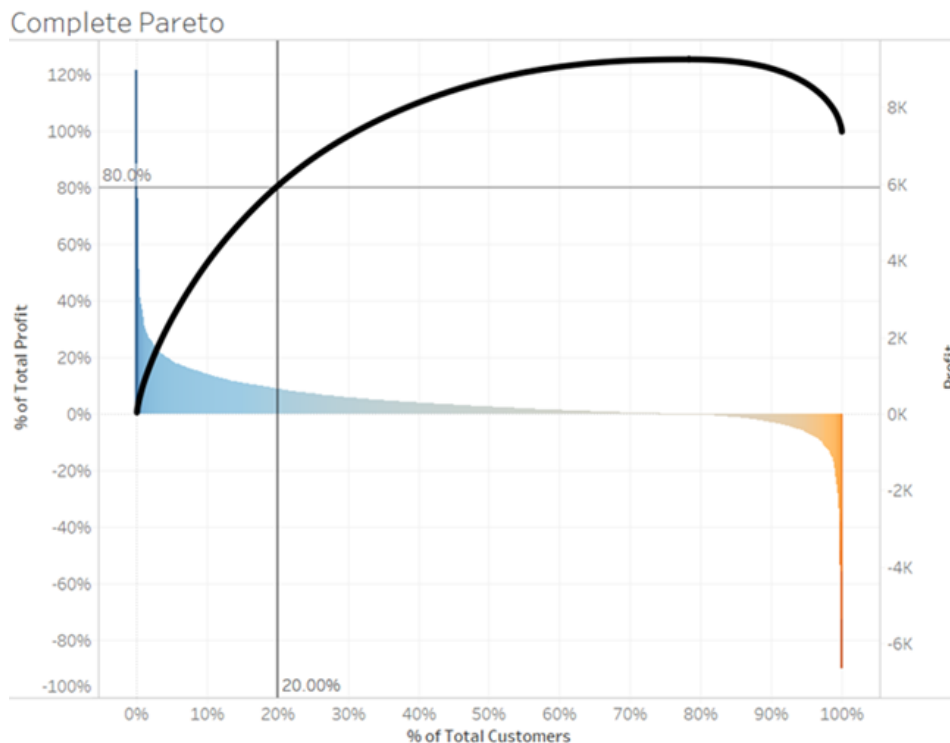


Directions

1. Duplicate the **Basic Pareto** worksheet and name the copy "Intermediate Pareto".
2. Copy **Customer ID** from **Columns** to **Detail** on the **Marks** card.
3. On **Columns**, right-click on **Customer ID**, click **Measure** and then **Count Distinct**.
4. On **Columns**, right-click on **Customer ID** and choose **Add Table Calculation**:
 - **Calculation Type: Running Total, Sum**
 - **Compute Using: Specific Dimensions**, ensure **Customer ID** is checked
 - Select **Add secondary calculation**
 - **Secondary Calculation Type: Percent of Total**
 - **Compute Using: Specific Dimensions**, ensure **Customer ID** is checked
5. On the **Marks** card, change the mark type to **Bar**.
6. Resize the marks to the smallest setting.
7. From the **Data** pane, drag **Profit** to **Color** on the **Marks** card.
8. For the **% of Total Running Sum of Profit** axis, add a constant reference line with a value of 0.80, scoped to the table. Show the value as a label. In **Tableau Desktop** only, format as a thin gray line.
9. For the **% of Total Running Sum of Distinct Count of Customer ID** axis, add a constant reference line with a value of 0.20, scoped to the table. Show the value as a label. In **Tableau Desktop** only, format as a thin gray line.

Part 3: Complete Pareto

In a duplicate view of **Intermediate Pareto**, add **Profit** as a secondary axis, show the **SUM(Profit)** Δ mark as a line and formatted, and rename the axes to be more descriptive.



Directions

1. Create a duplicate of the **Intermediate Pareto** worksheet and name the copy "Complete Pareto".
2. From the **Data** pane, drag another instance of **Profit** to **Rows**, to the right of the existing **SUM (Profit)** Δ , and then right-click on the new **SUM(Profit)** and select **Dual Axis**.
3. Create the line for % of Total Profits:
 - Right-click on the **% of Total Running Sum of Profit** axis, select **Mark Type**, click **Line**, and then **Move marks to front**.
 - Ensure **SUM(Profit)** Δ is still selected on the **Marks** card.
 - Remove **SUM(Profit)** from **Color**.
 - Change the line color to black and increase the size of the line.
4. Edit the names of the axes:
 - Change the axis title for **% of Total Running Sum of Profit** to "% of Total Profit".
 - Change the axis title for **% of Total Running Sum of Distinct count of Customer ID** to "% of Total Customers".

Solution

For the solution to this practice, see "Solution: Pareto Chart" on page 86.

3. Level of Detail Expressions

This module contains the following:

Practice: Customer Order Frequency (FIXED)

Practice: Country and Customer Sales (INCLUDE)

Practice: Country and Regional Sales (EXCLUDE)

Practice: Average Shipping Costs (Nested)

Practice: Choosing Calculation Types



Practice: Customer Order Frequency (FIXED)

You are interested in how many of your customers have made more than one purchase as well as the most common number of purchases your customers have made. After showing the number of purchases made by each customer, use a FIXED LOD expression in a second view to show how many customers made 1, 2, N purchases.

Count of Orders per Customer



Labels intentionally blurred in this example

Directions

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Create an initial view to determine the distinct number of **Order ID** by **Customer ID**.
4. Sort in descending order by **Order ID** and name the sheet "Orders per Customer".
5. Click the **New Sheet** button to create a new sheet.
6. Create a LOD expression named "Orders per Customer" that returns the distinct number of orders per customer.
7. Create a view that shows the distinct number of orders per customer sliced by the distinct number of customers. (**HINT**: Remember that FIXED LOD expressions have unique dimensionality properties.)
8. Show mark labels in the view.
9. Name the sheet "Count of Orders Per Customer".

SELF CHECK 1 How many customers made exactly 12 purchases?

SELF CHECK 2 What is the most common number of purchases made by customers?

SELF CHECK 3 How many customers made the most common number of purchases?

Solution

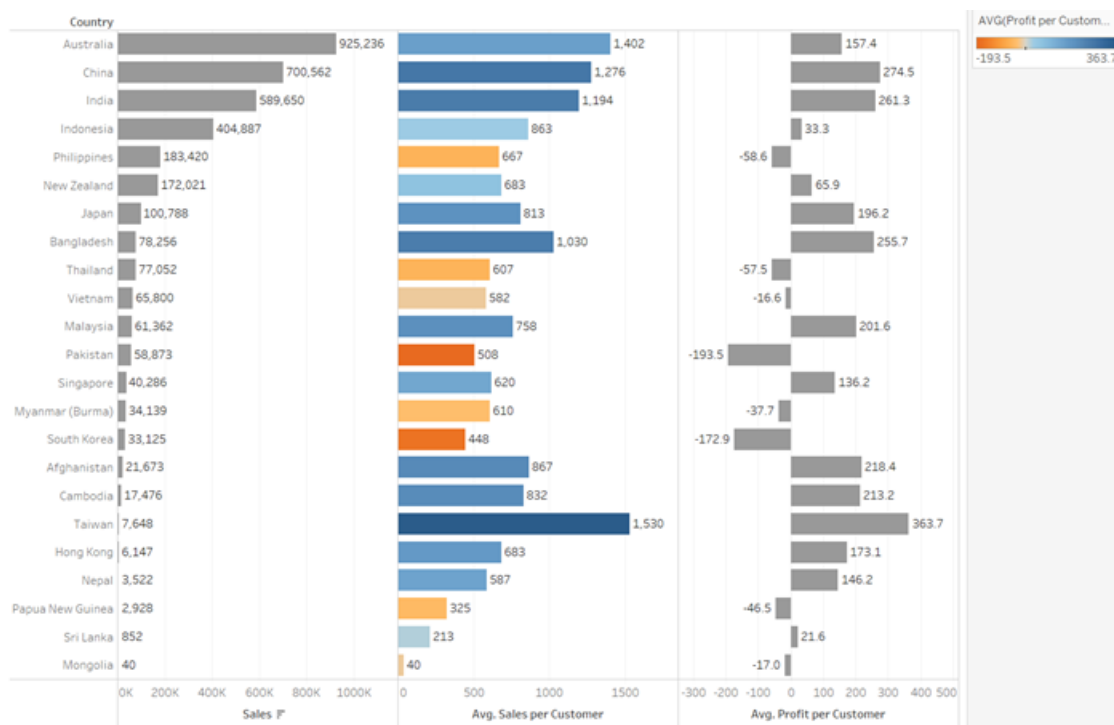
For the solution to this practice, see "Solution: Customer Order Frequency (FIXED)" on page 89.



Practice: Country and Customer Sales (INCLUDE)

You would like to compare the average sales vs. average profits for countries and customers within the **APAC Market**.

Create a bar chart that shows overall sales and profit for countries before using INCLUDE LOD expressions to compare those values against the average sales and average profit per customer. Then, show average profit on color **Average Sales per Customer** axis, to compare the average sales vs. average profit for countries.



Directions

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Drag **Sales** to **Columns** and **Country** to **Rows**.
4. Filter the view to countries in the **APAC Market**.
5. On **Country**, sort descending by sum of **Sales**.
6. On the **Marks** card, show mark labels.
7. Create an LOD expression called "Sales per Customer" to determine the sales per unique customer.

8. Drag **Sales per Customer** to **Columns** to the right of **SUM(Sales)**, and then change the aggregation to **Average**.
9. Create an LOD expression called "Profit per Customer" to determine the profit per unique customer.
10. Drag **Profit per Customer** to the right of **AVG(Sales per Customer)** on **Columns**, and then change the aggregation to **Average**.
11. On the **Marks** card, click **AVG(Sales per Customer)** to expand it.
12. CTRL+drag a copy of **AVG(Profit per Customer)** from **Columns** to **Color** to compare profit against sales using color.
13. Change the view to **Fit Height**.

SELF CHECK 1 Which country had the most sales?

SELF CHECK 2 Which country had the largest average sales by customer?

SELF CHECK 3 How many countries had customers whose average orders were unprofitable?

SELF CHECK 4 Why might a **FIXED** LOD expression return incorrect results in this scenario?

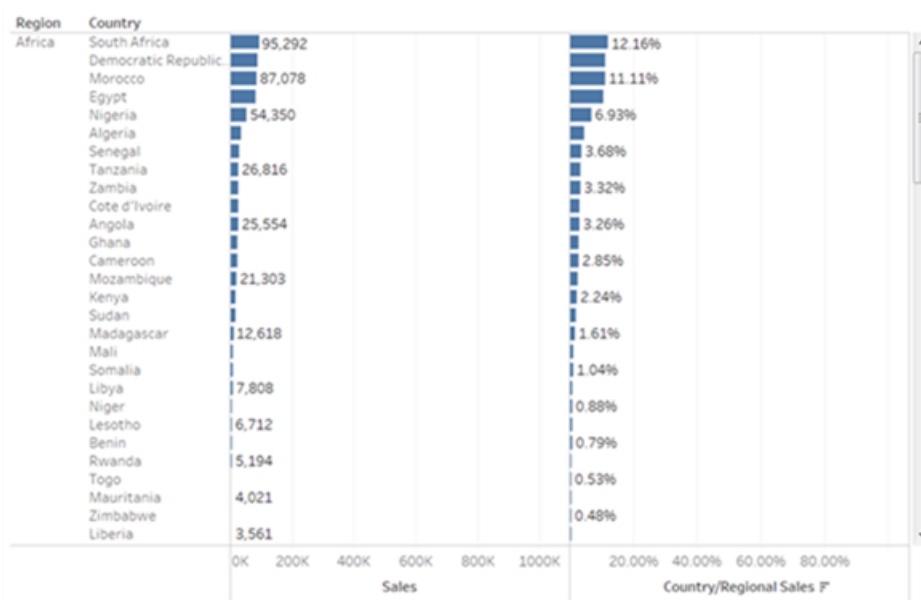
Solution

For the solution to this practice, see "Solution: Country and Customer Sales (INCLUDE)" on page 89.



Practice: Country and Regional Sales (EXCLUDE)

You would like to determine which country within each region in the **EMEA Market** contributes the greatest percentage to overall regional sales. First, determine overall sales for the countries in the **EMEA** market. Then, use an **EXCLUDE** LOD expression to compare those values against the percent of sales for each country's region.



Directions

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Create the initial view: drag **Sales** to **Columns**, and drag **Region** and **Country** to **Rows**.
4. Filter the view to the **EMEA Market**. (Note: One of the regions within the **EMEA** market also happens to be named **EMEA**.)
5. On the **Marks** card, click **Label** and then **Show mark labels**.
6. Create an LOD expression called "Exclude Country from Sales" to determine sales in the view excluding country.
7. Then, create a calculated field called "Country/Regional Sales" that divides the sales of a country in the view by the value of the EXCLUDE LOD expression that you just created.
8. Drag **Country/Regional Sales** to **Columns**, to the right of **SUM(Sales)**.
9. In the **Data** pane, change the number format for **Country/Regional Sales** to **Percentage**.
10. On the **Country** field on **Rows**, sort descending by **Country/Regional Sales**.

SELF CHECK 1 In the entire **EMEA** market, which two countries contributed the highest percentage of sales to their respective regions, and what were the values?

SELF CHECK 2 How might you show **Country/Regional Sales** as a percentage using a method other than changing its number format?

Solution

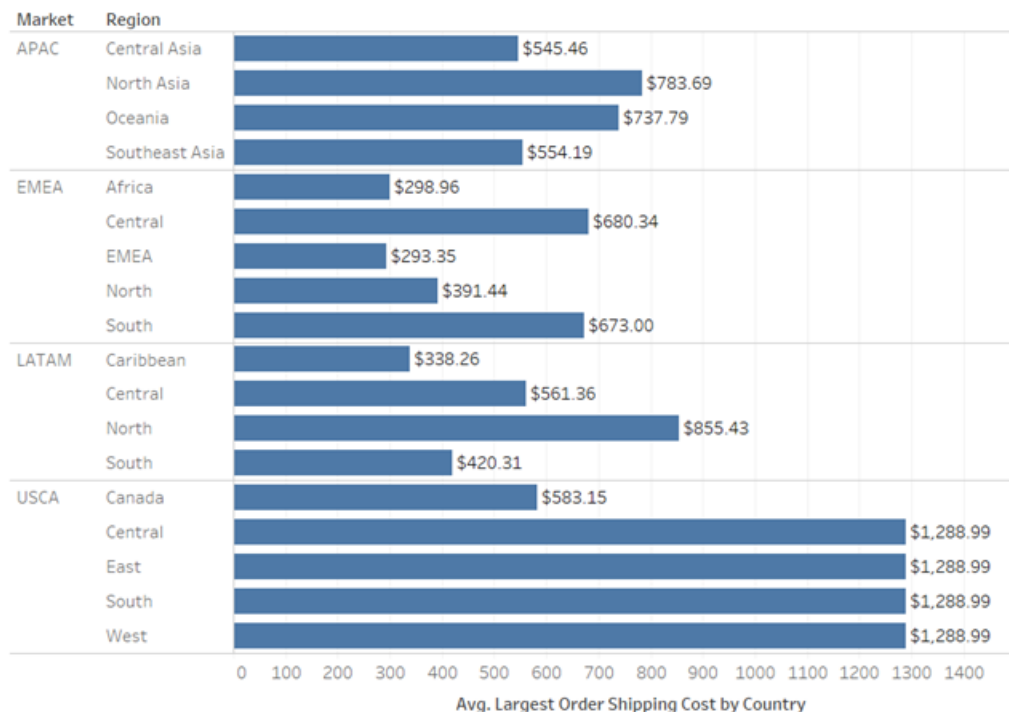
For the solution to this practice, see "Solution: Country and Regional Sales (EXCLUDE)" on page 90.



Practice: Average Shipping Costs (Nested)

You're interested in how shipping costs vary by country and would like to determine which of your regions and markets have the highest average shipping costs.

First, use a nested LOD expression to determine maximum shipping cost for an order in a given country. Then, create a bar chart that shows the average maximum shipping costs for countries by market and region.



Directions

1. Connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Drag **Market** and **Region** to **Rows**.
4. Create a nested LOD expression called "Largest Order Shipping Cost by Country" that determines the largest shipping cost for the orders within a given country.
(**HINT** As you create the LOD expression, think of the question you are answering: for each country, what is the largest shipping cost for an order?)
5. Drag **Largest Order Shipping Cost by Country** to **Columns**, and change the aggregation to **Average**.
6. CTRL+drag **AVG(Largest Order Shipping Cost by Country)** from **Columns** to **Label** on the **Marks** card, and format the number to display as currency with two decimal points.
7. Change window fit to **Entire View**.

SELF CHECK Why are there identical values for some regions in the USCA market?

Solution

For the solution to this practice, see "Solution: Average Shipping Costs (Nested)" on page 91.

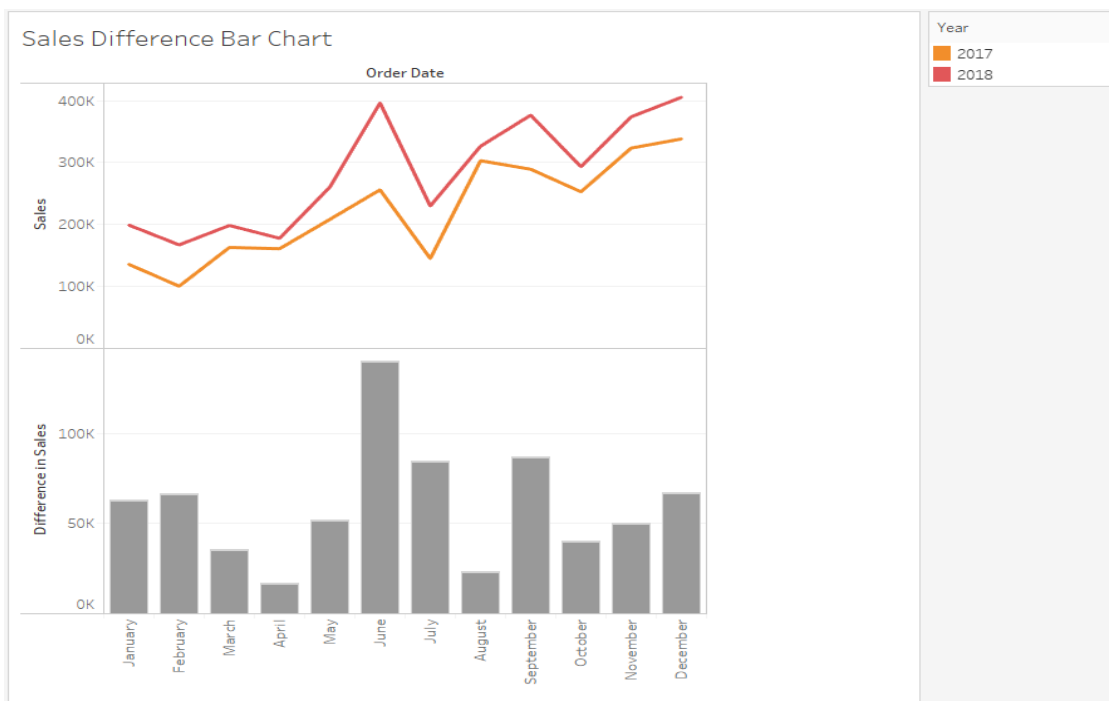


Practice: Choosing Calculation Types

For each question, consider the goal and the visualization and then decide which calculation type or types could work well to achieve the intended result. (There may be more than one way to answer each question.)

OPTIONAL If time permits, try building one or more of the goal visualizations using the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder). Use the **Orders** sheet for your views.

1. **Sales Difference Bar Chart:** Show monthly sales for the years 2017 and 2018 as a line chart, alongside a bar chart that shows the monthly difference in sales for those years.



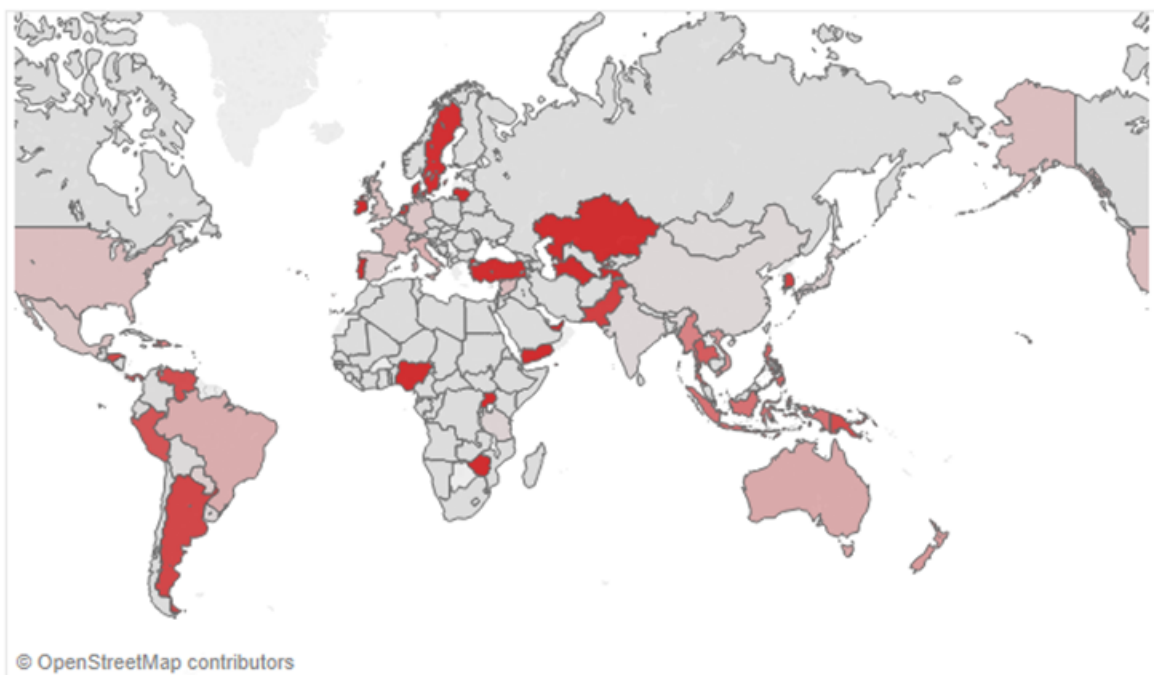
2. **Sales Difference Highlight Table:** Show the same information as in the previous view, but using a highlight table.

Sales Difference Highlight Table

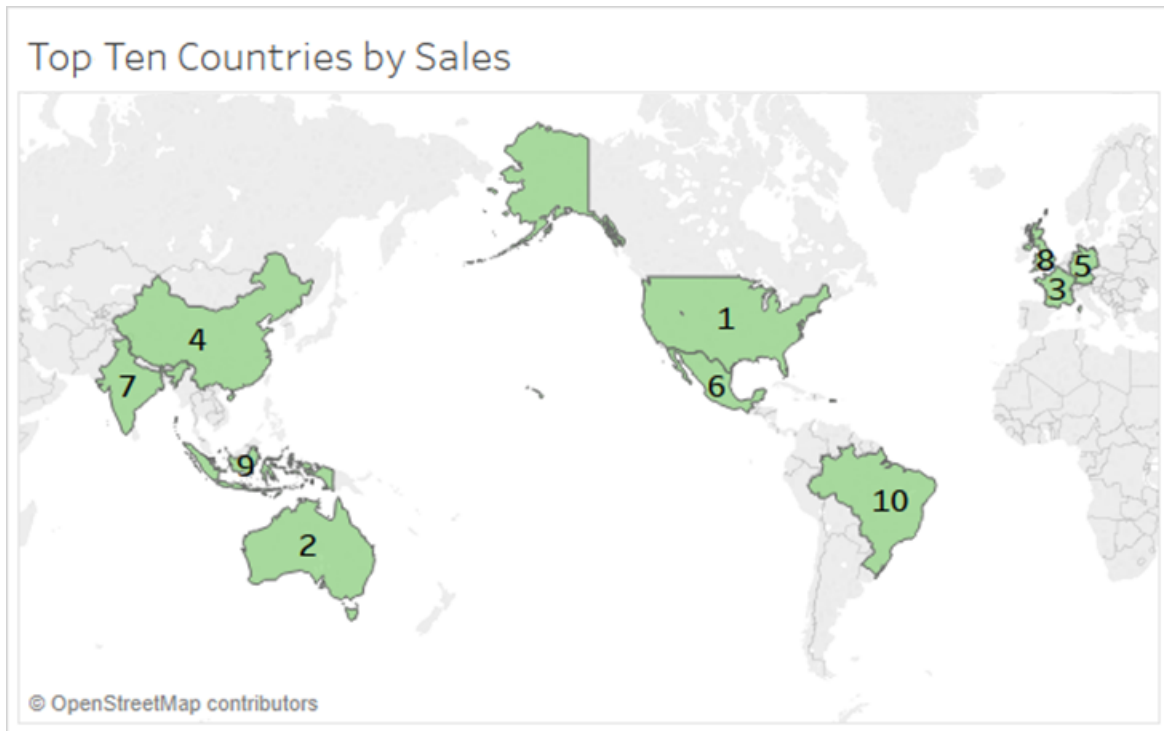
	Order Date											
	January	February	March	April	May	June	July	August	September	October	November	December
2017 Sales	135,781	100,510	163,077	161,052	208,365	256,176	145,237	303,143	289,389	252,940	323,512	338,257
2018 Sales	199,186	167,240	198,594	177,821	260,499	396,520	229,929	326,489	376,619	293,407	373,989	405,454
Difference	63,405	66,729	35,517	16,769	52,134	140,344	84,692	23,346	87,230	40,467	50,477	67,197

3. **Percentage of Unprofitable Products:** Show the percentage of unprofitable products by country on a map using color intensity.

Percentage of Unprofitable Products



4. **Top Ten Countries by Sales:** Show the top ten countries by sales on a map that shows the rank on Label.



Solution

For the solution to this practice, see "Solution: Choosing Calculation Types" on page 93.

4. Analyzing Time-Based Data

This module contains the following:

Practice: Creating a Chart with Sparklines

Practice: Creating a Control Chart

Practice: Creating a Bump Chart

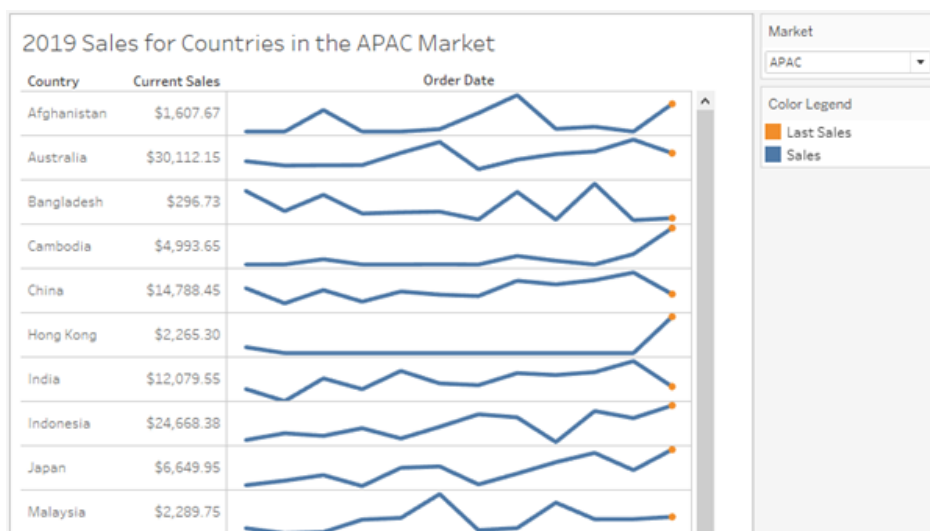
Practice: Creating a Slope Chart



Practice: Creating a Chart with Sparklines

You want to create a visualization that will clearly show 2019 sales trends for all countries within a given market, formatted for quick comparison. To do so, you will use sparklines to show Global Superstore sales information for 2019 by **Country** and filtered by **Market**, with each row on an independent axis. Showing the filter and creating a calculated field to display headers for **Country** and **Current Sales** enables users to see trends for the market they choose. A customized title, adjusted columns and rows, and orange end points increase readability.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.



Directions

1. From Tableau Desktop, connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Create the initial view:

Drag This	To
Sales	Rows
Country	Rows (to the left of SUM(Sales))
Market	Filters , with All selected, and filter shown as a single value dropdown.
Order Date	Filters , with #Years format and 2019 selected
Order Date	Columns , expanded to discrete month, and with the year and quarter removed and with the header not showing

4. Edit the **Sales** axis to set independent axis ranges for each row or column.

5. On **Rows**, format **SUM(Sales)** so that marks show at **Default Value**. (**HINT: Format, Pane, Special Values, Marks.**)
6. Set the **Grid Lines** and **Zero Lines** in the view to **None**.
HINT: Format, Lines.
7. Create a calculated field called "Last Sales" that is written as follows:
`IF LAST()=0 THEN ZN(SUM([Sales])) END`
8. Place the new field **Last Sales** on **Rows** and right-click to create a dual axis.
9. Synchronize the **Last Sales** axis to the **Sales** axis.
10. Remove the header for the **Last Sales** axis.
11. On **Rows**, format **Last Sales** so that **Special Values** are set to **Hide (Break lines)**.
HINT: Format, Pane, Special Values, Marks
12. Create a calculated field called "Current Sales" that is written as follows:
`ZN(LOOKUP(SUM([Sales]), LAST()))`
13. Place **Current Sales** on the **Rows** shelf after **Country** and convert to **Discrete**.
14. Format **Current Sales** to **Currency** and set alignment to **Right**.
15. Remove the header for **Sales** from the view.
16. Change the height of the rows by dragging to create shorter rows.
17. Use the keyboard shortcut of CTRL+Left Arrow (←) to narrow the column for the line showing **Sales**.
18. Set the colors so that the sparklines are blue and the end points are orange.
19. Edit the title to read "2019 Sales for Countries in the <Market> Market".

Solution

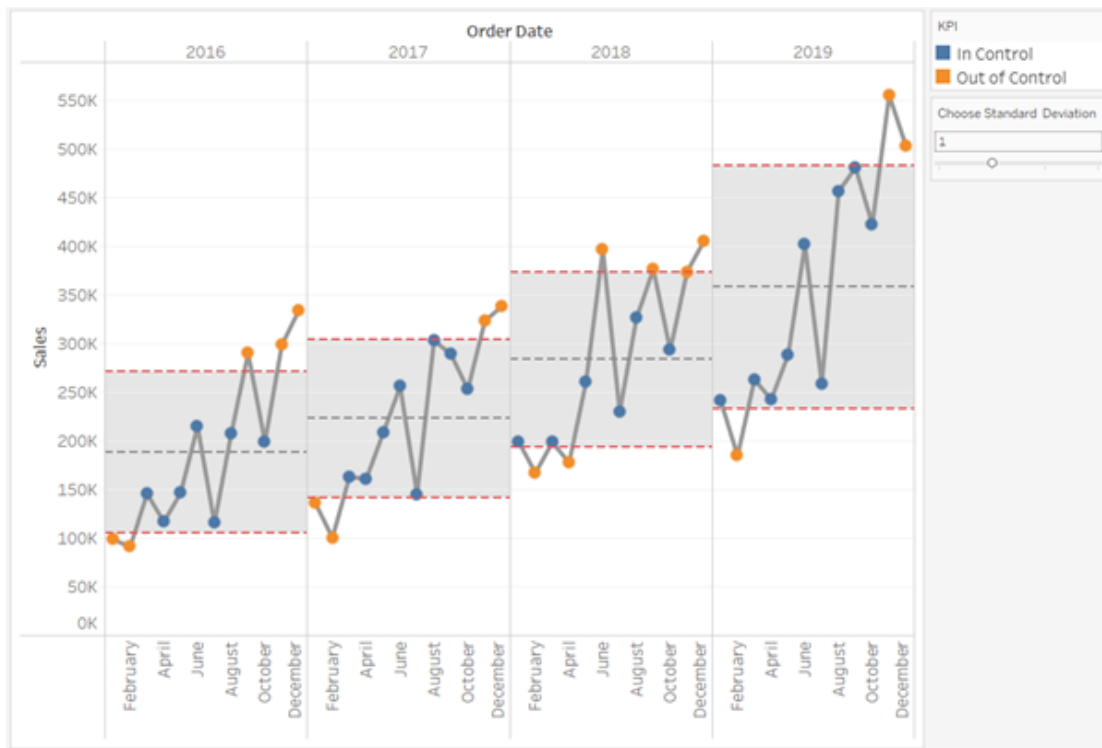
For the solution to this practice, see "Solution: Creating a Chart with Sparklines" on page 93.



Practice: Creating a Control Chart

You would like to use a Key Performance Indicator (KPI) to see when sales are inside and outside control limits. You would also like to adjust those control limits and to see deviations at the yearly level.

You will create a view that uses a KPI. Then, you will add a parameter to adjust the upper and lower control limits before scoping deviations at the yearly level to show different ranges for multiple years.



Directions: Create the initial view

1. From Tableau Desktop, connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Drag **Sales** to **Rows**.
4. Drag **Order Date** to columns.
5. Drag a second instance of **Order Date** to **Columns** and select the **Month (May)** date part format.

Create the average line and control limits

1. On the **Sales** axis, add a reference line for average sales:
 - **Value:** SUM(Sales) set to **Average**.
 - **Label:** None
 - **Tableau Desktop only:** Use a gray dashed line.
2. Create a calculated field called "Upper Control Limit" written as follows:

$$\text{WINDOW_AVG}(\text{SUM}([\text{Sales}])) + \text{WINDOW_STDEV}(\text{SUM}([\text{Sales}]))$$

3. Duplicate the calculated field, rename it "Lower Control Limit" written as follows:
`WINDOW_AVG(SUM([Sales])) - WINDOW_STDEV(SUM([Sales]))`
4. Add **Upper Control Limit** and **Lower Control Limit** to **Detail** on the **Marks** card.
5. From the **Analytics** pane, add a reference band to **Pane** using the control limits as boundaries:
 - **Band from:** Lower Control Limit set to **Minimum**.
 - **Band to:** Upper Control Limit set to **Maximum**.
 - **Label:** None on both.
 - **Tableau Desktop only:** Use a red dashed line and a light gray fill.
6. On **Upper Control Limit** on the **Marks** card, change **Compute Using** to **Pane (across)**.
7. Repeat the previous step for **Lower Control Limit** on the **Marks** card.

Create a key performance indicator (KPI)

1. Drag another instance of **Sales** to **Rows**, to the right of **SUM(Sales)**.
2. Expand **SUM(Sales)(2)** on the **Marks** card, remove the **Lower Control Limit** and **Upper Control Limit** fields, and change the mark type to **Circle**.
3. Change the second **Sales** axis to **Dual Axis**.
4. On the **Sales** axis on the right side of the view, click **Synchronize Axis**, and then hide the header.
5. Create a calculated field to add color to the circles named "KPI" written as follows:
`IF SUM([Sales]) > [Upper Control Limit] or SUM([Sales]) < [Lower Control Limit] THEN "Out of Control" ELSE "In Control" END`
6. Expand **SUM(Sales) (2)** on the **Marks** card and drag **KPI** to **Color**.
7. Adjust circle sizes if desired.
8. **Tableau Desktop only:** Edit the title of the **KPI** legend to read "KPI".

Create a parameter to adjust standard deviation

1. Create a parameter named "Choose Standard Deviation" as follows:
 - **Allowable values:** Range
 - **Min:** 0
 - **Max:** 3
 - **Step size:** 1
2. In the **Data** pane, do the following:
 - Edit **Upper Control Limit** as follows:
`WINDOW_AVG(SUM([Sales])) + WINDOW_STDEV(SUM([Sales])) * [Choose Standard Deviation]`
 - Edit **Lower Control Limit** as follows:
`WINDOW_AVG(SUM([Sales])) - WINDOW_STDEV(SUM([Sales])) * [Choose standard Deviation]`
3. Show the parameter control.
4. Adjust the slider on the control and observe the results.

SELF CHECK 1 When standard deviation is set to 1, how many months are above the control limit?

SELF CHECK 2 How many months are below the control limit?

Solution

For the solution to this practice, see "Solution: Creating a Control Chart" on page 95.

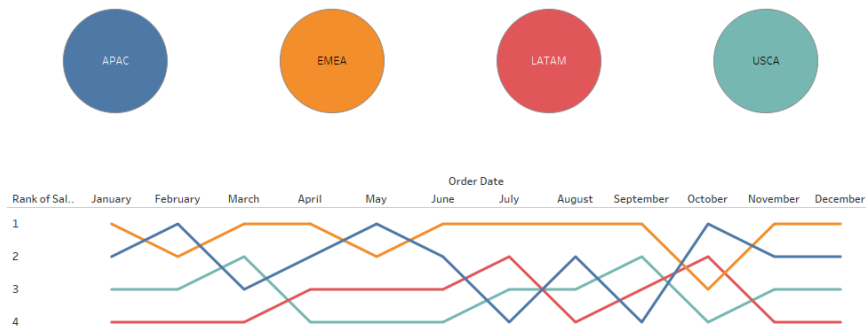


Practice: Creating a Bump Chart

You want to enable users to quickly view rank trends in sales for the four markets in the **Global Superstore.xlsx** data set for the 2017 calendar year. Create a bump chart and a highlight table view to show relative sales rankings by month for each market. Optionally, create an interactive dashboard to explore both views.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.

Hover to view rank trends in sales.



Highlight Table

Rank of Sal..	January	February	March	April	May	June	July	August	September	October	November	December
1	\$54K	\$42K	\$68K	\$48K	\$73K	\$114K	\$61K	\$142K	\$109K	\$103K	\$101K	\$111K
2	\$51K	\$35K	\$38K	\$40K	\$61K	\$72K	\$33K	\$97K	\$65K	\$59K	\$86K	\$85K
3	\$18K	\$13K	\$37K	\$38K	\$42K	\$39K	\$31K	\$39K	\$60K	\$59K	\$78K	\$75K
4	\$13K	\$10K	\$20K	\$35K	\$31K	\$30K	\$20K	\$26K	\$55K	\$32K	\$58K	\$67K

Directions:

Create the Bump Chart View

1. From Tableau Desktop, connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Create a new sheet named "Bump Chart" as follows:

Drag This	To
Sales	Rows
Order Date	Columns, in the date part (May) format.
Market	Color on the Marks card

- From the **Data** pane, drag **Order Date** to **Filters**, click **#Years**, and select **2017**.
- On **Rows**, add a table calculation to **SUM(Sales)** with the following options:
 - Calculation type: **Rank, Descending, Competition (1, 2, 2, 4)**
 - Compute Using: **Specific Dimensions**, clear the **Month of Order Date** check box and select the **Market** check box.
- Edit the **Rank of Sales** axis:
 - Range: Fixed**
 - Start: 1**
 - End: 4**
 - Scale: Reversed**
- On **Rows**, convert **SUM(Sales)** Δ to **Discrete**.
- On the **Marks** card, choose the **Line** mark type.
- Drag the bottom edge of the view to adjust the size.

Convert the Bump Chart to a Highlight Table View

- Duplicate the **Bump Chart** worksheet as a crosstab, and name the new worksheet "Highlight Table".
- From **Rows**, drag **Market** to **Color**.
- Change the mark type to **Bar**.
- On the **Marks** card, create an ad-hoc calculated field with the constant value of **1**.
- Change the new ad-hoc field to a **Dimension**, and then assign it to **Size**.
- From the **Data** pane, drag **Sales** to **Label** on the **Marks** card.
- Drag the bottom edge of the view to adjust the overall size.
- Adjust the **Size** slider to enlarge the marks to fill the view.

Bonus: Create an Interactive Dashboard

Create a Market Button Worksheet

- Create a new worksheet, and name it "Markets".
- From the **Data** pane:
 - Drag **Market** to **Columns**.
 - Drag **Market** to **Text** on the **Marks** card.
- Change the mark type to **Circle**.
- From the **Data** pane, drag **Market** to **Color** on the **Marks** card.
- Hide the header row.
- On the **Marks** card:
 - Use horizontal center alignment for the label text.
 - Adjust the size to increase the size of the circles, and then drag the column and row edges to adjust as necessary.

7. Format the view to have no borders between row panes. (**HINT: Format, Borders, Row Divider, Pane.**)
8. On the **Marks** card, add a dark gray border around the circles.
9. Edit the worksheet title to say "Hover to view rank trends in sales".

Build the Dashboard

1. Add a new dashboard named "Bump Chart and Highlight Table".
2. Drag the worksheets you created onto the dashboard, with **Markets** at the top, **Bump Chart** in the middle, and **Highlight Table** on the bottom, using layout options as needed or appropriate.
3. Remove the color and size legends.
4. Hide the titles for the **Bump Chart** and **Highlight Table** sheets.
5. For each sheet, change the fit type to width.
6. On the **Dashboard** menu, click **Actions**.
7. Add a highlight action with the following settings:

Field	Setting
Name	"Market Button"
Source Sheets	Markets
Run action on	Hover
Target Sheets	Bump Chart and Highlight Table
Target Highlighting	Choose Selected Fields and then Market

8. Test the action on the dashboard.

SELF CHECK 1 Which market was ranked 1 the most number of months?

SELF CHECK 2 Which market was ranked 1 the least number of months?

SELF CHECK 3 Which market experienced the most variance in rank?

Solution

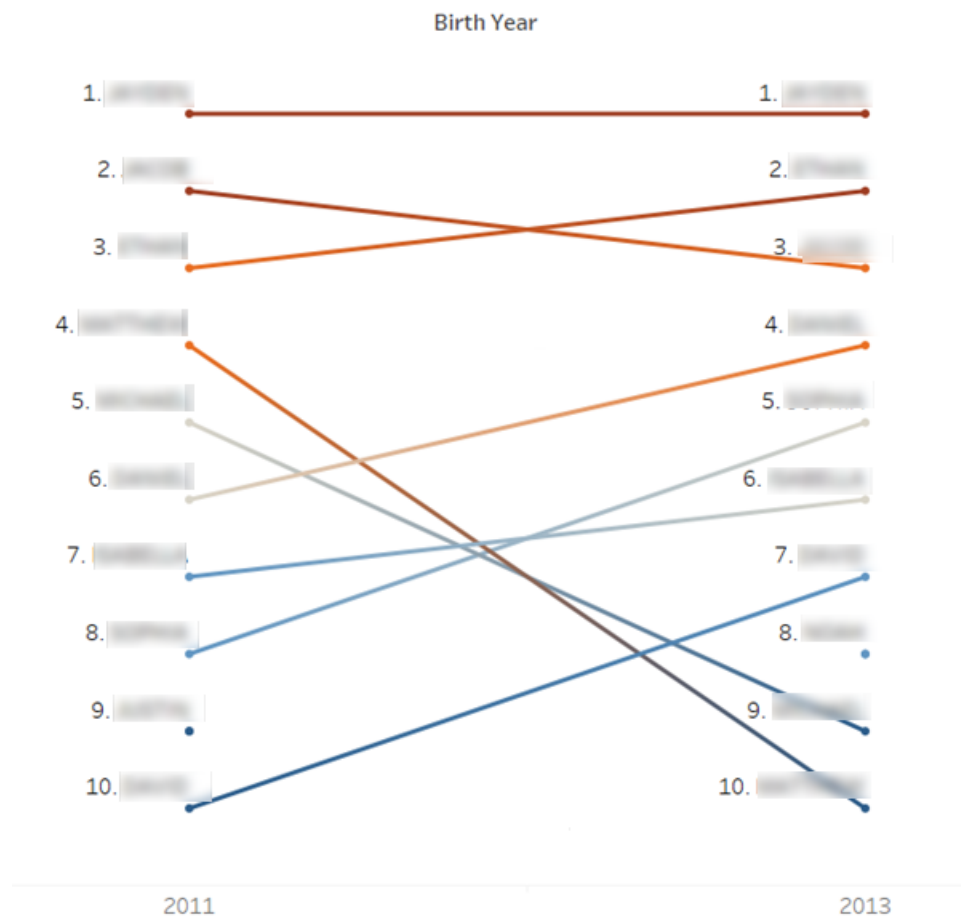
For the solution to this practice, see "Solution: Creating a Bump Chart" on page 97.



Practice: Creating a Slope Chart

You want to know the top ten most popular first names for babies born in New York City in 2011 and 2013. First, list the names ranked by popularity for the years 2011 and 2013 on opposite axes. Then, connect the names using lines, with circles at the end of each line for visual clarity. Finally, show ranking on the lines using a stepped color ramp.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.



Note: answers in this image are intentionally hidden

Directions

1. From Tableau Desktop, connect to the Excel data source **NYCBabyNames.xlsx** (in the **Practices\Data** folder).
2. Drag **Birth Year** to **Columns** and format as **Discrete**.
3. CTRL+drag a copy of **Birth Year** from **Columns** to **Filters**, and select **2011** and **2013**.

4. Drag **Count** to **Rows**.
5. Change mark type to **Line** and widen the columns in the view.

Add Name information

1. Drag **Name** to **Label** on the **Marks** card.
2. On **Rows**:
 - Add the **Rank** Quick Table Calculation to **SUM(Count)**.
 - Change **Compute Using** to **Name** on **SUM(Count)**.
3. CTRL+drag a copy of **SUM(Count)** Δ from **Rows** to **Filters**, and select a range from 1 to 10.
4. Edit the **Rank of Count** axis, and use a reversed scale.
5. On **Label**, show line ends.

Add Rank numbers and color to the view

1. CTRL+drag a copy of **SUM(Count)** Δ from **Rows** to **Label**.
2. Edit the label to read: "<Rank of SUM(Count)> <Name>"
3. CTRL+drag a copy of **SUM(Count)** Δ from **Rows** to **Color**.
4. On **Color**, under **Markers**, choose the **All** icon, and edit the color to use **Orange-Blue Diverging** and a **Stepped Color** of 5 steps.

Add final formatting

1. Hide the **Rank of Count** axis.
2. Hide the row grid lines. (**HINT**: Right-click view, click **Format**.)
3. Change the **Label** alignment to be top left aligned.

SELF CHECK 1 From the names and date ranges in the view, which had the largest increase in popularity by rank?

SELF CHECK 2 From the names and date ranges in the view, which had the largest decrease in popularity by rank?

Bonus: Use Calculated Fields and Filters in a Slope Chart

Now that you have determined which names had the largest respective increase and decrease in popularity by rank from 2011 to 2013, create a second slope chart that uses calculated fields and filters to show the popularity by rank of every name that was ever in the top ten in 2011 or 2013.

1. Duplicate the **Sheet 1** worksheet and name the new worksheet **Sheet 2**.
2. Create a new calculated field called "Rank":
`RANK(SUM([Count]))`
3. Create another new calculated field called "Window Min":
`WINDOW_MIN([Rank])`
4. Drag the newly created **Window Min** Δ to **Filters** on top of the **SUM (Count)** Δ field to replace it, and in the **Filters** dialog box, enter a range from 1 to 10.
5. Edit the **Window Min** table calculation in **Filters** as follows:
 - In the **Nested Calculations** section, click **Rank**.
 - Compute **Rank** by **Name**.
 - Click **X** to close the dialog box.

6. In **Window Min** Δ on **Filters**, reset the range from 1 to 10.

BONUS SELF CHECK 1 What was the popularity by rank of Noah in 2011? What was the popularity by rank of Justin 2013?

BONUS SELF CHECK 2 Why won't the single calculation `WINDOW_MIN(RANK(SUM([Count])))` work in step 2 instead of the separate calculations in steps 2 and 3?

Solution

For the solution to this practice, see "Solution: Slope Chart" on page 100.

5. Analyzing Customer Behavior

This module contains the following:

Practice: Annual Purchase Frequency by Customer Cohort

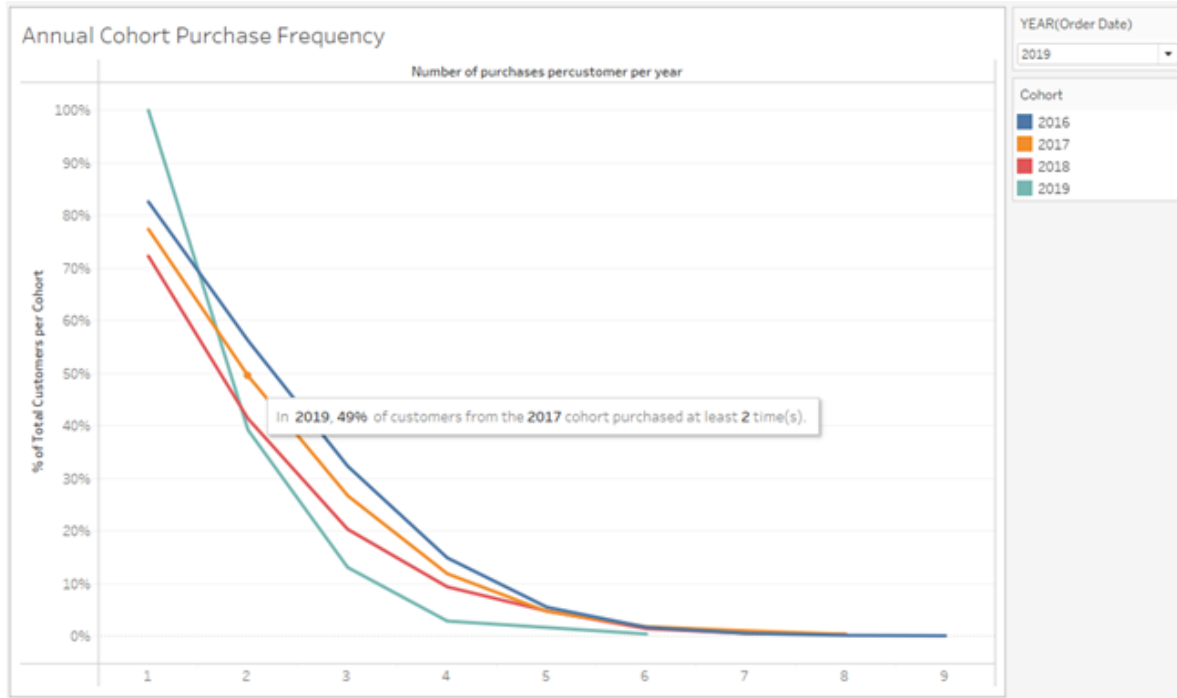
Practice: Student Survey



Practice: Annual Purchase Frequency by Customer Cohort

You're interested in the purchasing behavior of customer cohorts and want to determine whether more recent customer cohorts purchase more or less frequently than older cohorts. You're also interested in the percentage of customers within each cohort who made 1, 2, 3, or more purchases a year.

First, create a chart showing frequency as a percentage with each year cohort as a separate line. Then add a filter to select year of order date and format the tooltip to provide additional information.



Directions: Build the initial view

1. From Tableau Desktop, connect to the Excel data source **Global Superstore.xlsx** (in the **Practices\Data** folder).
2. Use the **Orders** sheet for your analysis.
3. Bring count distinct of **Customer ID** to **Rows**, and select "Add All Members" if prompted.
4. Create a level of detail expression titled "Cohort" that groups the customers by cohort:
`{FIXED [Customer ID]: MIN (YEAR([Order Date]))}`
5. Make **Cohort** a dimension, and then drag to **Color**.
6. Create an LOD expression titled "Number of purchases per customer per year" that counts the number of orders made by each customer in each year. (**NOTE** It is unnecessary to include **Cohort** in this expression, since every customer belongs to only 1 cohort):
`{FIXED [Customer ID], YEAR([Order Date]): COUNTD([Order ID])}`
7. Make **Number of purchases per customer per year** a dimension, and then drag to **Columns**.
8. Set the mark type to **Line**.

9. Right-click and drag **Order Date** to **Filters**, choose **Years**, and then select all years.
10. Show the filter, configure it as **Single Value (dropdown)**, and select **2019** on the filter.

Change line chart from totals to a running sum

1. Add a Running Total quick table calculation to **CNTD(Customer ID)**.
2. Edit the table calculation:
 - Click **Specific Dimensions**, then ensure the **Number of purchases** check box is selected and **Cohort** is not checked.
 - Change the sort order from **Specific Dimensions** to **Custom**.
 - Sort by **Number of purchases per customer per year** and **Average**, and then select **Descending**.

Determine the percentage of customers per cohort making purchases in a year

1. CTRL+Drag **CNTD (Customer ID)** from **Rows** to the **Data** pane and rename the calculation "Running Total".
2. Create a calculated field titled "% of Total Customers per Cohort" to determine the total percentage of customers per cohort who purchased at least N number of times in year selected by the filter (divide the running total by the number of customers in the cohort):

$$\frac{[\text{Running Total}]}{\text{SUM}(\{\text{FIXED} [\text{Cohort}]: \text{COUNTD}([\text{Customer ID}])\})}$$
3. Replace the measure on **Rows** with **% of Total Customers per Cohort**.
4. Format **% of Total Customers per Cohort** as a percentage with zero decimal places.
5. **Tableau Desktop only:** Click on the null indicator and then click **Filter data** to exclude the nulls from the view.

Format tooltip

1. Drag **Order Date** from the **Data** pane to **Rows**, to the left of **% of Total Customers per Cohort**, and hide the header.
2. Update the tooltip as follows: "In <YEAR(Order Date)>, <AGG(% of Total Customers per Cohort)> of customers from the <Cohort> cohort purchased at least <Number of purchases per customer per year> time(s)".
3. On the toolbar, change the view to **Entire View**.
4. Edit the title to read "Annual Cohort Purchase Frequency".

SELF CHECK 1 In 2019, what percentage of customers in the 2016 cohort purchased at least two times?

SELF CHECK 2 Which yearly cohort exhibits the most customer loyalty?

Solution

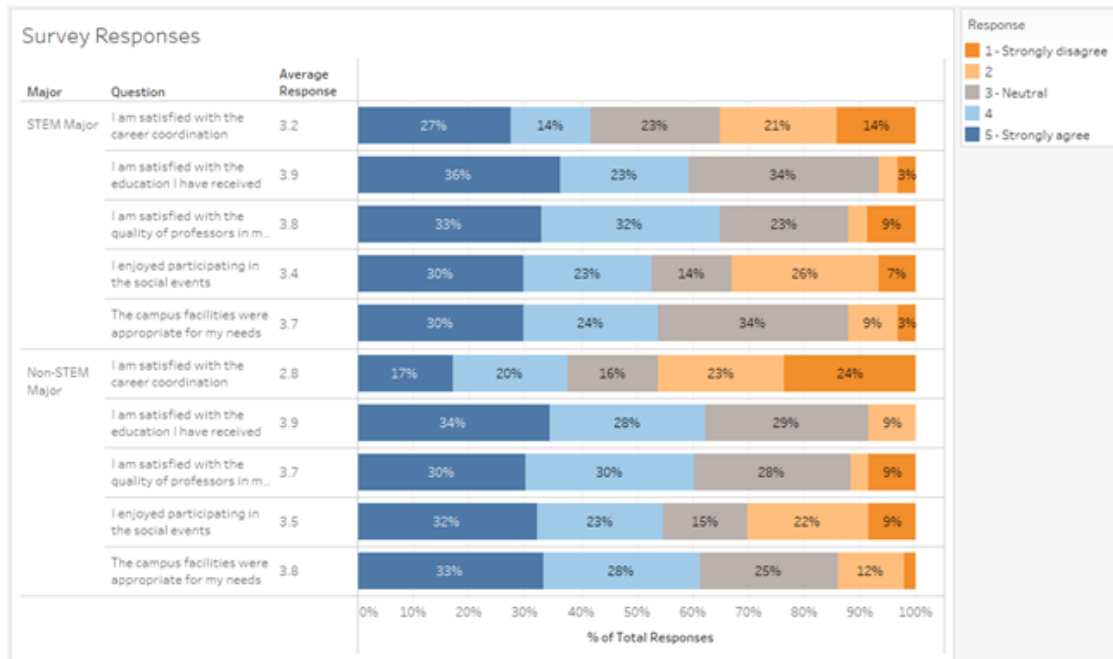
For the solution to this practice, see "Solution: Annual Purchase Frequency by Customer Cohort" on page 102.



Practice: Student Survey

You want to create a view that displays student survey results with responses per question labeled as a percentage, broken out by STEM (Science, Technology, Engineering, and Mathematics) and Non-STEM majors, and showing the average response for each question.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.



Directions

1. Use **Student Satisfaction.xlsx** (found in the **Practices\Data** folder).
2. Click the **Data Source** tab, and in the **Data** grid or the **Metadata** grid, pivot **Q1** through **Q5**:
 - Rename **Pivot Field Names** to "Question".
 - Rename **Pivot Field Values** to "Response".
3. Go to **Sheet 1**.

Create a blend using the Helper file to edit primary aliases

The **Survey Data** table in the data source lists the questions as **Q1**, **Q2**, **Q3**, and so on. Descriptions for each question exist in the Helper file, a separate file in the **Data** folder in your **Practices** folder.

1. Connect to **Helper file.xlsx**.
2. Click the new worksheet button to go to **Sheet 2**.
3. Using **Survey Data**, drag **Question** to **Rows**.
4. Using **Helper File**, drag **Description** to **Rows**.

5. On **Rows**, right-click **Description**, select **Edit Primary Aliases**, and then click **OK**. The **Question** column from **Survey Data** should now be populated with the **Description** from **Helper File**.
6. Go back to **Sheet 1** and name the worksheet "Survey Responses".

Create the view

1. From the **Student Satisfaction** data source, drag **Survey Data (Count)** to **Columns**, and then create a percent of total table calculation by cell to fill the whole cell to 100%.
2. CTRL+drag **CNT(Survey Data)**△ from **Columns** to **Label** on the **Marks** card.
3. Format it so it shows percentage with zero decimal points.
4. From the **Data** pane, drag **Major** and **Question** to **Rows**.
5. Manually sort **Major** so that **STEM Major** appears above **Non-STEM Major** in the view.
6. Create a copy of **Response** called "Response (Dimension)", convert it to a dimension, then drag it to **Color**.
7. Edit the colors using the **Tableau 20** color palette so that the numbers 1-5 appear as follows:
 - 1 = dark orange
 - 2 = light orange
 - 3 = gray
 - 4 = light blue
 - 5 = dark blue
8. Edit the color legend title to read "Response".
9. Edit the descriptions on the color legend (HINT: use **Edit Aliases**):
 - Rename 1 to "1 - Strongly Disagree"
 - Rename 3 to "3 - Neutral"
 - Rename 5 to "5 - Strongly Agree"
10. Create an LOD calculation called "Average Response" as follows:


```
{FIXED[Major], [Question]: AVG([Response])}
```
11. Drag **Average Response** to **Rows**, to the right of **Question**.
12. Edit **SUM(Average Response)** to be **Discrete**, and format to show 1 decimal point.
13. Edit the axis to read "% of Total Responses".
14. Edit the tooltip:
 - Remove entries for the table calculation and for the LOD expression.
 - Change the text before <Response (Dimension)> to "Response".
15. Click the **Fit** drop-down menu and select **Entire View**.

Solution

For the solution to this practice, see "Solution: Student Survey" on page 104.

6. Geographical Analysis

This module contains the following:

Practice: Using Marks Layers for Maps

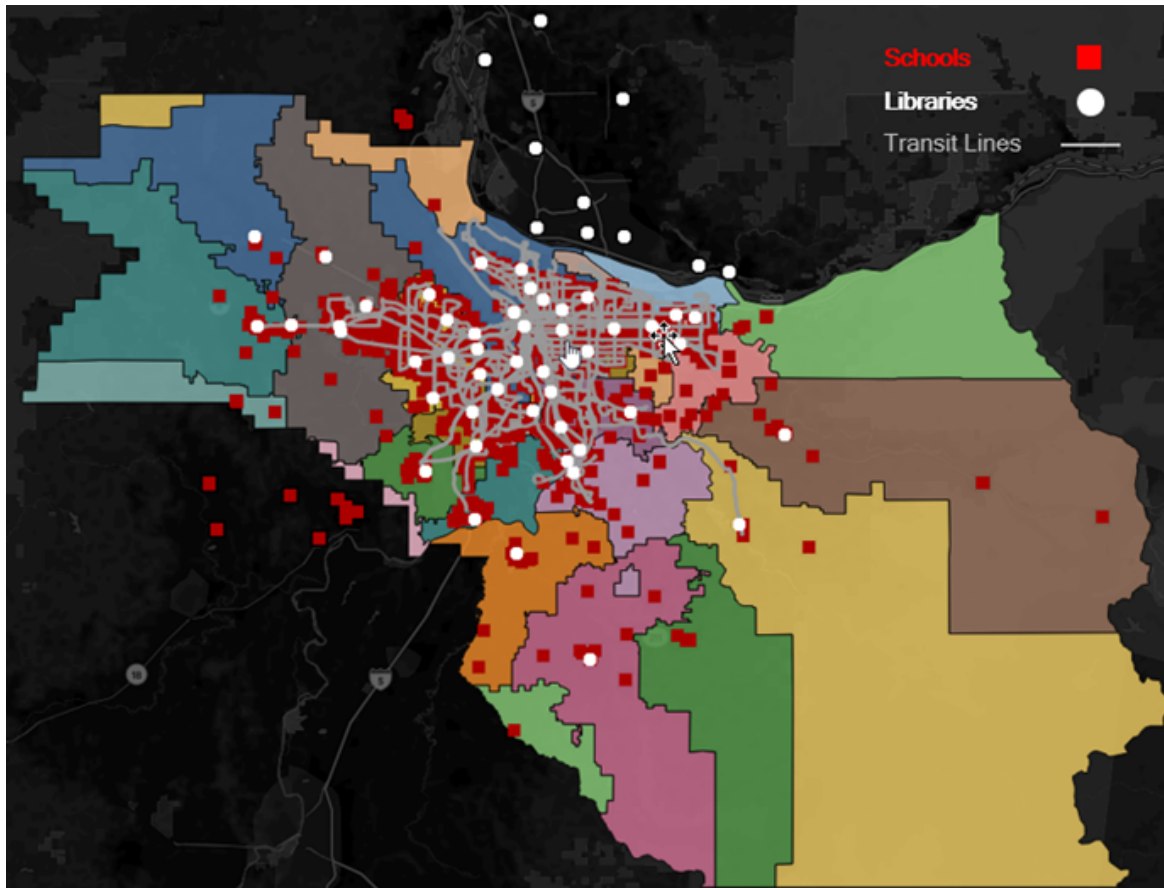
Practice: Creating a Hexbin Map

Practice: Advanced Spatial Files



Practice: Using Marks Layers for Maps

You are relocating your company to the Portland, Oregon area. Many of your staff are concerned with schools, libraries, and public transit in the areas they will settle. You want to see a view with multiple map layers showing neighborhoods, schools, libraries, and proximity to public transit.



Create the initial map with School Districts and Libraries

1. Open **Using_Marks_Layers_for_Maps_Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
2. View the relationships to see how multiple spatial files are connected.
3. Click **Sheet1**, and rename it "Greater Portland (OR) Resource Map".
4. Create an initial view with the **School District Boundaries** shape file and **Distname** on **Color**.
5. Using the **Libraries** table, add an additional map layer to the view using **Shape (Libraries)**.

SELF CHECK 1 Locate Banks on the map. How many libraries are in Banks?

6. From the **Libraries** table, add **Name** to **Detail** on the **Marks** card for **Libraries.Shape**.
7. Disable the selection for **School District Boundaries.Shape**.

8. Make the following changes to the **Libraries.Shape** layer:
 - Change the color to white with a dark gray border.
 - Change the mark type to circle.
 - Increase the size of the circle slightly.

Add Marks Layers for Schools and Transit Lines

1. Add **Shape (Schools)** to the view, and from the **Schools** table drag **Name** to **Detail**.
2. On **Schools.Shape**, make the following changes:
 - Change the color to red with a light black border.
 - Change the mark type to square.
 - Decrease the size slightly.
3. Add **Transit lines** to the view and disable its selection.
4. Decrease the size of the **Transit lines** slightly, and move it below the schools and libraries layers.

SELF CHECK 2 Use the map's pan and zoom tools to view more detail up close. What trends do you notice? What additional questions might you ask?

Solution

For the solution to this practice, see "Solution: Using Marks Layers for Maps" on page 106.

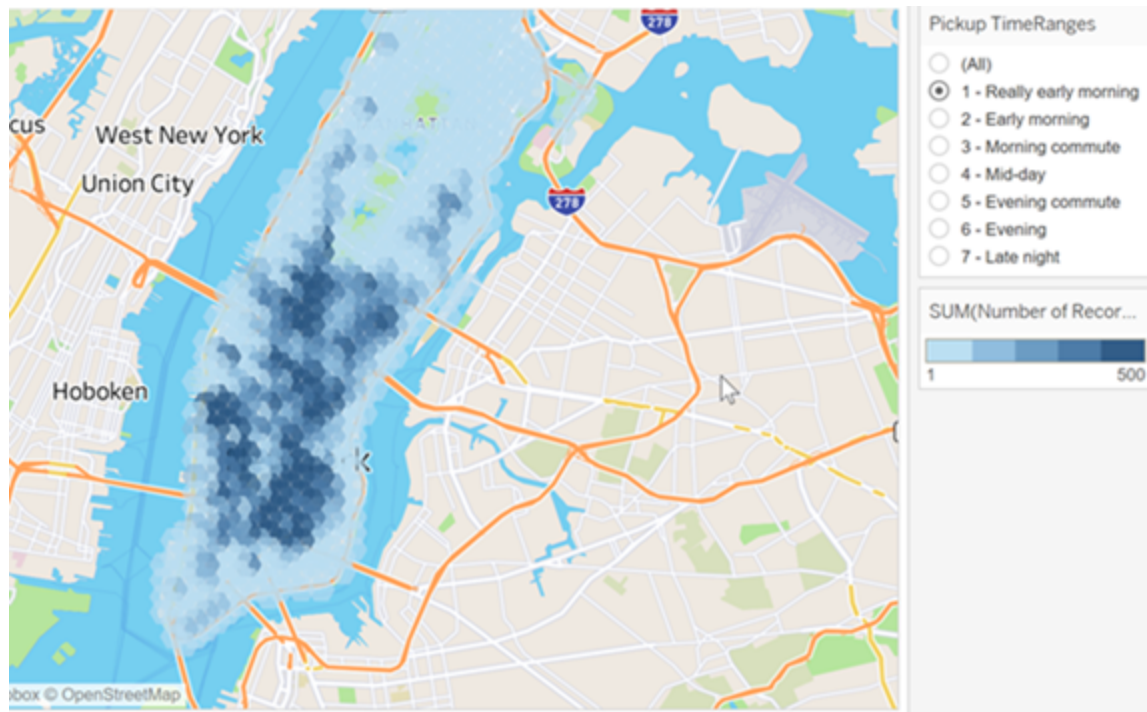


Practice: Creating a Hexbin Map

You want to create a hexbin map that shows density of taxicab pickups in Manhattan, New York, which users can filter for different times of the day. In order to scale the hexbins appropriately for the data, you'll create an intermediate parameter to adjust the layout of the view which is not intended for user control.

Your map will show the distribution of data in hexbins that properly tessellate, or fit together, evenly across the surface in a range from 0-500, with 5 color steps, without showing the parameter control. Your map will provide a time range filter for users.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.



Directions: Create the initial view

1. Open **Hexbin Map Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
2. Sheet 1 shows instances of taxicab pickups plotted geographically in New York City. Drag **Pickup TimeRanges** to **Filters**, and select **Really early morning**.
3. Show the filter in the view, and configure the filter as a **Single Value List**.
4. Change the view type to **Shape**.
5. Create a parameter called **Scale Factor**. **TIP** The scale factor parameter is used to adjust the view for formatting, and is then removed from the final view.
 - **Data type:** Integer
 - **Current value:** 500

- Allowable values: Range
 - Minimum: 50
 - Maximum: 1000
 - Step size: 10
6. Show the parameter control.

Create hexbin fields that include the scale factor

1. Create a calculated field called "HexbinX" written as follows:

```
HEXBINX([Pickuplon] * [Scale Factor], [Pickuplat] * [Scale Factor]) /
[Scale Factor]
```

2. Create a calculated field called "HexbinY" written as follows:

```
HEXBINY([Pickuplon] * [Scale Factor], [Pickuplat] * [Scale Factor]) /
[Scale Factor]
```

3. Convert **HexbinX** and **HexbinY** to dimensions.
4. For **HexbinX**, set the **Geographic Role** to **Longitude**.
5. For **HexbinY**, set the **Geographic Role** to **Latitude**.

Create a hexbin map and adjust the size of the hexbins

1. Drag **HexbinX** to **Columns**, and drop on top of **Pickuplon**, replacing it.
2. Drag **HexbinY** to **Rows**, and drop on top of **Pickuplat**, replacing it.
3. Drag **Number of Records** to **Color**.
4. Edit the color of the view to show a blue color range with 5 steps.
5. Create a new folder in the **Shapes** directory (Windows: My Documents (Mac: Documents)\My Tableau Repository\Shapes) called "Hex".
6. Copy **hex_solid.png** from the **Data** folder in the **Practices** folder into the new **Hex** folder.
7. On the **Marks** card, click on **Shape**, and then click **More Shapes**.
8. Click **Reload Shapes**, click **Apply**, click the drop-down and navigate to the **Hex** folder, click the solid hexagon, click **Apply**, and then click **OK**.

Adjust the formatting

1. Adjust the map zoom so that Manhattan is the visual focus of the view.
2. Adjust both the size of the hexagons on the **Marks** card and the scale factor until the resolution of the view is informative and the hexagons tessellate, or fit together, properly.
3. Hide the parameter control.
4. Edit the color legend in the view and adjust the range of the scale to start at 1 and end at 500.
5. Adjust the background from **Light** to **Streets**.
6. Adjust the background map layers to show base, terrain, highways, cities, neighborhoods, and subway stations.
7. Adjust the opacity of the marks to about 80%.

SELF CHECK What time of day seems to have the most pickups?

Solution

For the solution to this practice, see "Solution: Creating a Hexbin Map" on page 107.

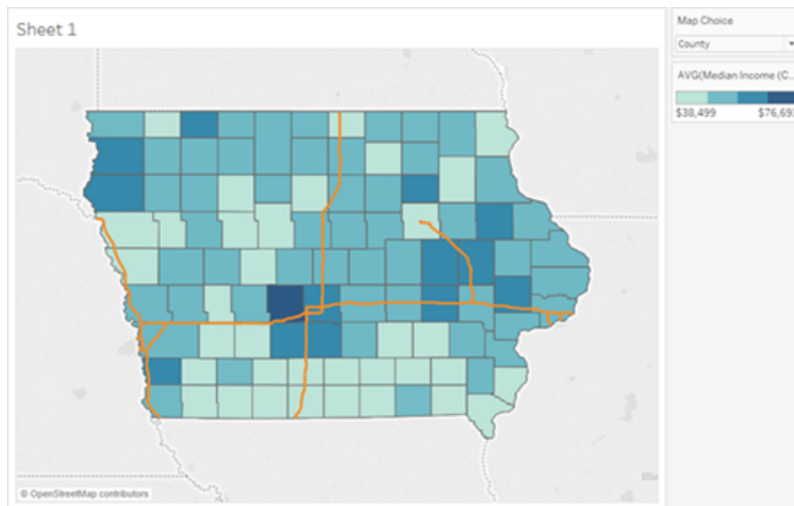


Practice: Advanced Spatial Files

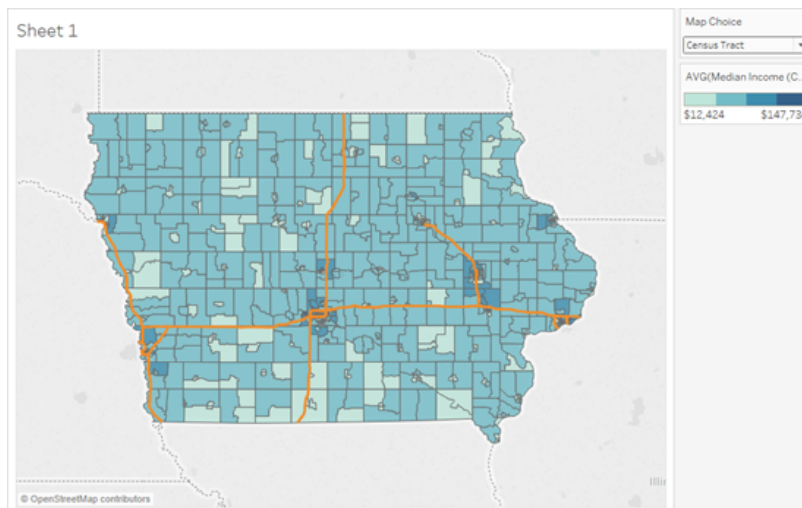
You're interested to know the median income per household in the state of Iowa in 2015.

Create a view with map options that allows users to see average median income by county or by census tract, and to adjust a color-coded income range to match their selected map option. Then, convert the map to a dual-axis map that shows the location of interstate highways regardless of which map option is selected.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.



Map showing average median household income by county



Map showing average median household income by census tract

Directions: Connect to the Spatial Files

1. Open **Advanced Spatial Files Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
2. On the **Data Source** tab, add a connection to the **IA_County_Boundaries.shp** file located in the **Data** folder in the **Practices** folder.
3. Join the **County FIPS** field in the **2015 Median Income Iowa.csv** file to the **Co Fipsco**d field in the **IA_County_Boundaries.shp** file. Use inner joins for this practice.
4. Add a connection to the **IA_census_2015_19_tract_500k.shp** file located in the **Data** folder in the **Practices** folder.
5. Join the **Tract GeoID** field in the **2015 Median Income Iowa.csv** file to the **Geoid** field in the **IA_census_2015_19_tract_500k.shp** file.
6. Add a connection to the **IA_Interstate_Highway_System.shp** file located in the **Data** folder in the **Practices** folder.
7. Join the **Road Status** field in the **2015 Median Income Iowa.csv** file to the **Road Status** field in the **IA_Interstate_Highway_System.shp** file.

Create the parameter and calculated fields

1. On **Sheet 1**, create a parameter called "Map Choice" as a string list using the following list values:
 - **Value:** "County", **Display As:** "County"
 - **Value:** "Census Tract", **Display As:** "Census Tract"
2. Create a calculated field called "Map Hierarchy" to distinguish between the county and census tract shape files:

```
IF ([Map Choice] == "County") THEN
  [Geometry]
ELSE
  [Geometry (IA census 2015 19 tract 500k.shp)]
END
```

3. Create a calculated field called "Median Income (Calculated)" to aggregate income at either the county or census tract level:

```
IF ([Map Choice] == "County") THEN
  {FIXED [County]: AVG([Median income (est.)])}
ELSE
  [Median income (est.)]
END
```

4. Change the default properties for the **Median Income (Calculated)** field so that it aggregates using average and has a custom currency number format that uses zero (0) decimal values.

Create a Parameter-Controlled Map

1. Use the **Map Hierarchy** field to create a map.
2. From the **Data** pane, in the **State Name, County** hierarchy, use the **County** field to add a level of detail to the view.
3. From **2015 Median Income Iowa.csv**, use the **Tract Name** field to add a level of detail to the view.
4. Show the **Map Choice** parameter in the view.

5. Use the **Median Income (Calculated)** field to create a color legend for the view.
6. Adjust the color legend to use 4 step color.

Create a Dual-Axis Map to Include Interstate Information

1. Use the **Longitude (generated)** field on **Columns** to duplicate the existing map.
2. Remove all fields from the duplicated version of the map.
3. Use the **Geometry (IA Interstate Highway System.shp)** field to create an interstate highway map on the duplicated map, and then color the interstate lines dark orange.
4. Convert the duplicated map into a dual-axis map.
5. Use the **Map Choice** parameter control to change the detail from the county level to the census tract level and observe the results.

SELF CHECK 1 Which county in Iowa had the highest median income, and which census tract within that county had the highest median income?

SELF CHECK 2 What impact (if any) does the location of an interstate highway have on the median income of a county or census tract?

Solution

For the solution to this practice, see "Solution: Advanced Spatial Files" on page 110.

7. Advanced Techniques for Dashboards

This module contains the following:

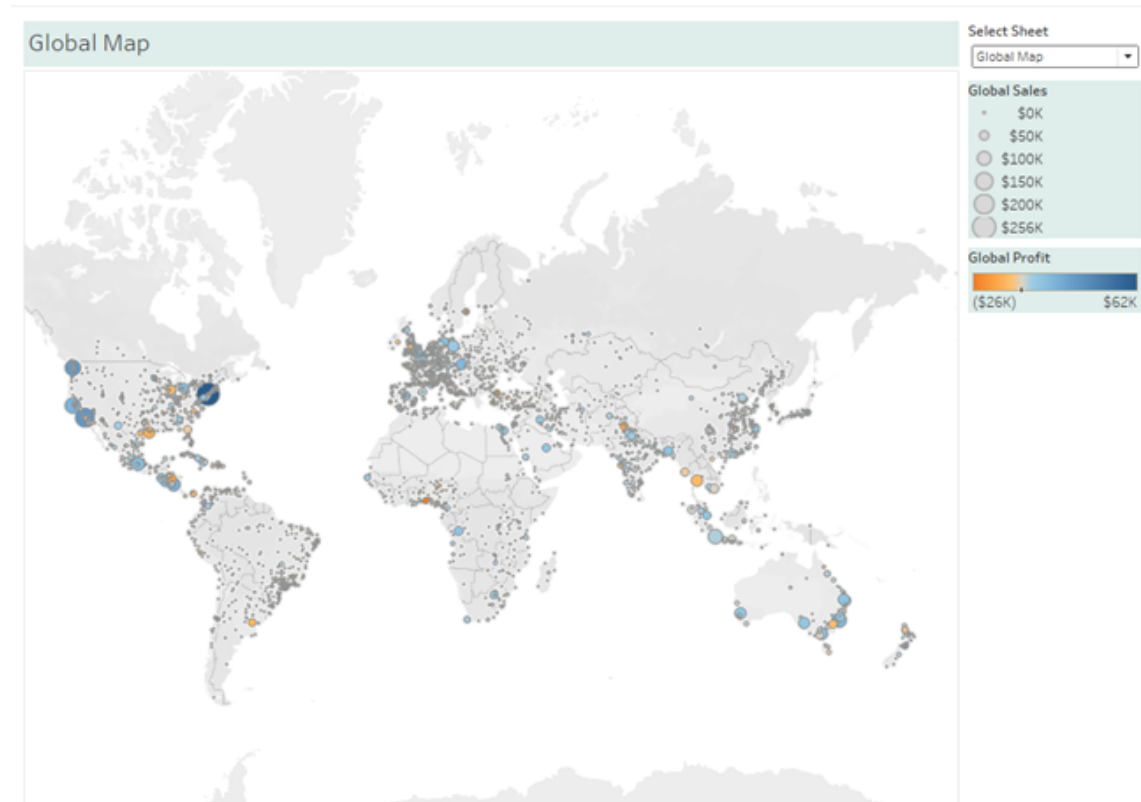
Practice: Dynamic Zone Visibility in Dashboards

Practice: Context Filters and Dashboards



Practice: Dynamic Zone Visibility in Dashboards

You want to create a dashboard that allows users to view different worksheets, with relevant legends displayed for each sheet. First, create a parameter and calculations. Then, use dashboard dynamic zone controls to display the selected view and legends.



Create Parameter and Calculated Fields

1. Open **Dynamic Zone_Starter.twbx** (found in the **Practices\Workbooks\Starters** folder), which contains worksheets for **Scatter Plot**, **Global Map**, and **Bar Chart**. Note the corresponding color shading for each view and its legend(s).
2. On the **Scatter Plot** view, create a string parameter called "Select Sheet" with a list for the following: **Scatter Plot**, **Global Map**, **Bar Chart**.
3. Show the parameter control.
4. Create a Boolean calculated field called "Scatter" that contains the **Select Sheet** parameter, using the following syntax: `[Select Sheet] = "Scatter Plot"`
5. Use this process to create Boolean calculated fields titled "Map" and "Bar" to return **True** when the user selects **Global Map** or **Bar Chart** in the parameter.

Create the Dashboard

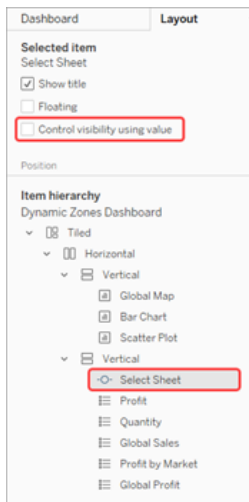
1. Open a new dashboard, and drag a vertical tiled container to the view.
2. Drag **Scatter Plot** into the container.

3. Drag **Global Map** and **Bar Chart** into the container. **TIP** Make sure the container is highlighted dark blue before dropping the worksheet.
4. Select each view, click the drop-down arrow, point to **Legends**, and ensure that the associated color and size legends are selected so that all legends display on the dashboard.
5. Position the parameter control above the legends.

Apply Dynamic Zone Visibility

1. Apply dynamic zone visibility for the scatter plot, using the following steps:
 - Select **Scatter Plot** on the parameter control and then, on the dashboard, select the **Scatter Plot** view.
 - On the **Layout** pane, under **Selected Item**, select **Control visibility using value**, and select **Scatter** from the drop-down menu. This associates the displayed view with the Boolean calculation.
 - Repeat these steps for legends associated with the scatter plot.
2. Use this process to apply zone visibility for the global map and bar chart views.

TIP If you accidentally associate the parameter control with a dynamic zone, the parameter control may no longer be visible on the dashboard. To correct this, use the **Item hierarchy** section of the **Layout** pane to select the parameter and then, under **Selected item**, clear the **Control visibility using value selection**. Once a dashboard object, such as a worksheet, legend, or parameter, is selected in the **Item hierarchy**, you can review or modify its settings, even when that object does not display on the canvas.



3. Test the parameter control.

NOTE The Dynamic Zone feature is new in Tableau version 2022.3. To prepare for Tableau certification exams testing on earlier versions, or to work with workbooks created in Tableau versions 2022.2 and earlier, complete "Bonus Practice: Sheet Swapping and Containers" on page 117, which provides an alternative method for using a parameter to control dashboard display views.

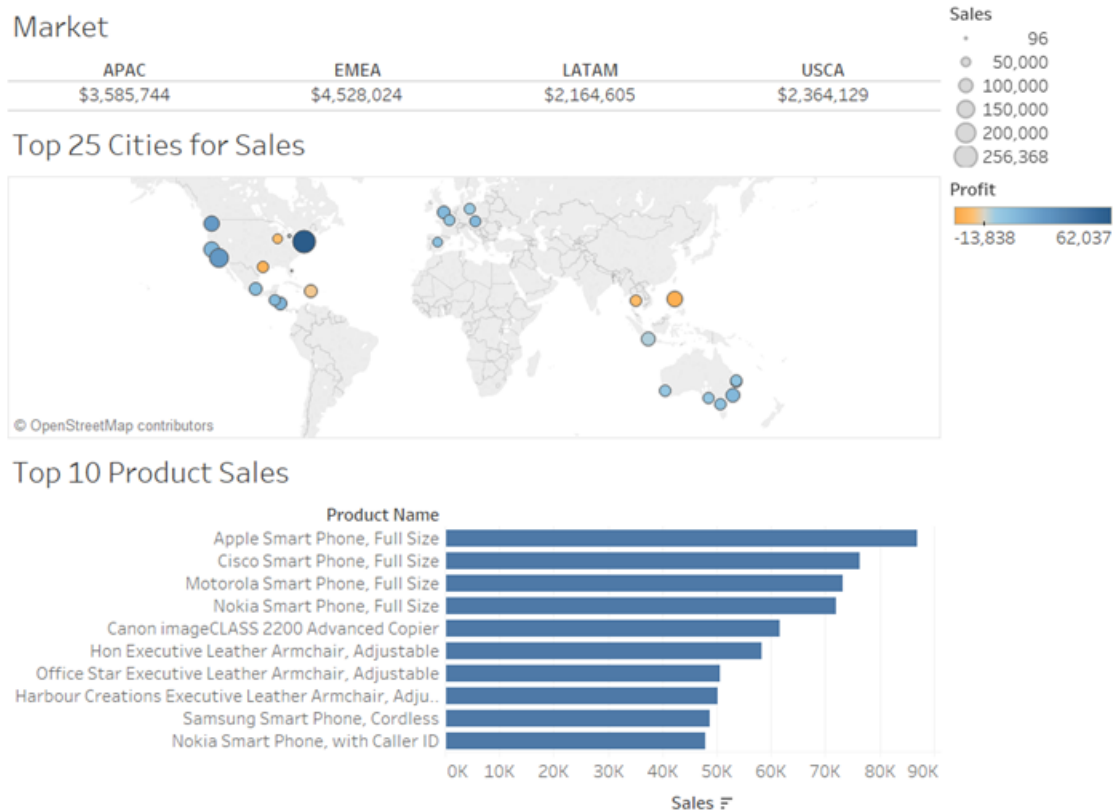
Solution

For the solution to this practice, see "Solution: Dynamic Zone Visibility in Dashboards" on page 112.



Practice: Context Filters and Dashboards

You would like to build a dashboard to show the top 25 selling cities within a given market and the top 10 selling items in any selected city. After bringing worksheets into your dashboard, use filters and context filters to view top cities and products within a given market. Then use filter actions to show the top 10 selling products for an individually selected city.



Create the initial view

1. Open **Context Filters and Dashboard Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
The starter has two sheets: **Top 10 Product Sales**, and **Top 25 Cities for Sales**, that do not have filters set up yet, so they currently show more than 10 and 25 results, respectively.
2. Create a dashboard called "Worldwide Sales" using the two sheets, with the map on top.
3. Create a new intermediate sheet called "Market" to use as a filter: drag **Market** to **Columns** and **Sales** to **Text**, and fit to **Entire View**.
4. Format the view. Follow the directions for your environment:

From Tableau Desktop:

- Format the sales figures as

Or From the Browser:

- Format the sales figures as

From Tableau Desktop:	Or From the Browser:
Currency with zero decimal places, and center the text alignment.	Currency with zero decimal places. <ul style="list-style-type: none"> Remove row dividers. If desired, increase the font size for the view and hide the worksheet title.

5. Add the **Market** sheet to the top of the dashboard, resize to a narrow band, and hide field labels for columns.

Set up initial top N filters

1. On the **Top 10 Product Sales** worksheet, add a filter for top 10 **Product Names** by **Sales**.
2. On the **Top 25 Cities for Sales** worksheet, add a filter for the **City and State** field for top 25 by **Sales**.
3. On **Worldwide Sales**, use the **Market** sheet as a filter for the dashboard, and then select various markets to observe the results on the dashboard. What do you notice?
4. On the **Top 10 Product Sales** worksheet, add **Action (Market)** to **Context**.
5. Repeat the previous step on the **Top 25 Cities by Sales** worksheet.
6. Go back to **Worldwide Sales** and click on various markets. What do you notice now?

Create filter action so map will filter Product Sales view

1. Ensure that no markets are selected on the dashboard.
2. Create a dashboard filter action called "Filter Map to Top 10 Products".
 - Under **Source Sheets**, make sure **Top 25 Cities for Sales** is checked and the rest are unchecked.
 - Under **Target Sheets**, ensure that **Top 10 Product Sales** is checked and the rest are unchecked.
 - Run the action on **Select**, with all values shown after leaving the filter.
3. Click on a city on the map to engage the filter action. What do you notice?
4. Go back to the **Top 10 Product Sales** sheet, and add the filter for **Action (City, Country, State)** to **Context**.
5. On the **Worldwide Sales** dashboard, click on an individual city and observe the results.

Add optional formatting

1. Use the **Format** menu to open the **Animations** pane, and experiment with duration and style.
2. Click the **Layout** tab, select a container on the dashboard, and experiment with borders, background color, and padding.
3. Go back to the **Top 10 Product Sales** worksheet, and hide the Sort Controls. Then go back to the **Worldwide Sales** dashboard and try to change the sort order in **Top 10 Product Sales**. What do you notice?

Solution

For the solution to this practice, see "Solution: Context Filters and Dashboards" on page 115.

8. Appendix A: Practice Solutions

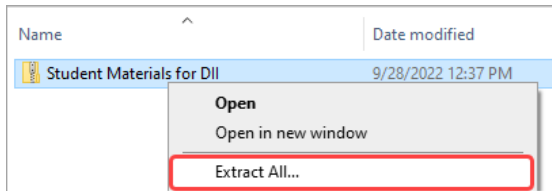
This section contains the solutions for all practices contained in this training manual.

Solution: Review - String Calculation for Customer Names

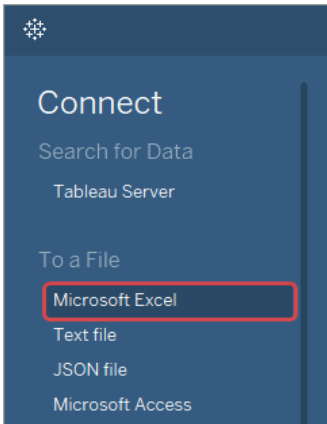
The following is a solution to "Practice: Review - String Calculation for Customer Names" on page 2.

Connect to Data

1. To begin, if you're working with a download link of a zipped **Materials** folder, right-click the folder and select **Extract All** to download the files if you have not previously done so.

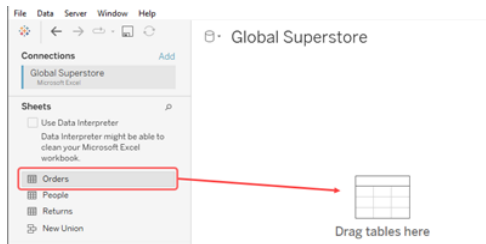


2. **IMPORTANT** You will now create the connection from either the Tableau Desktop application or from your browser-based site on Tableau Cloud or Tableau Server. The following table contains both sets of instructions for creating the connection.
 - For **Tableau Desktop**, follow the instructions "Connect to Data from Tableau Desktop".
 - For a browser-based site on **Tableau Cloud or Tableau Server**, follow the instructions "Connect to Data from the Browser".

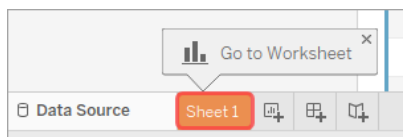
Connect to Data from Tableau Desktop:	<u>Or</u> Connect to Data from the Browser:
<ol style="list-style-type: none"> 1. Open Tableau Desktop, and under Connect click Microsoft Excel. 	<ol style="list-style-type: none"> 1. In the Student Materials folder, open the Data subfolder. 2. On the Explore page of your Tableau site, click New and then click Workbook.

Connect to Data from Tableau Desktop:

2. In the dialog box that opens, browse to the **Global Superstore.xlsx** data source, located in the **Data** folder within the **Practices** folder of **Student Materials** and click **Open**.
3. On the **Data Source** tab, in the **Connections** pane, under **Sheets**, double-click the **Orders** table to add it to the canvas, or drag and drop it to the **Drag tables here** area on the canvas.

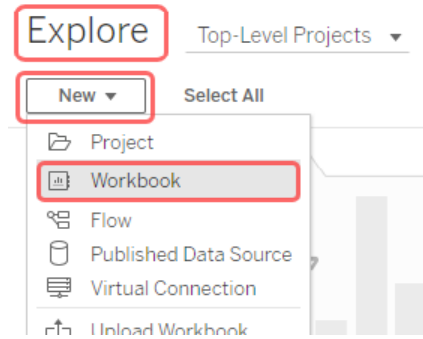


4. Click **Sheet 1** to go to the worksheet.

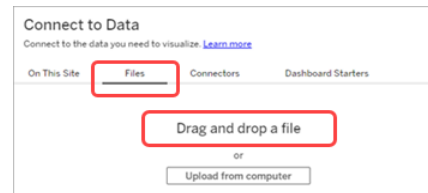


5. Continue to the section "Create Calculated Fields and Build a View".

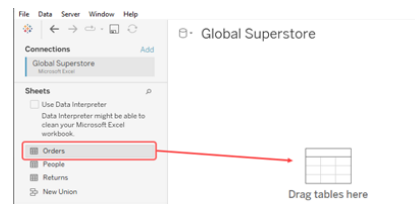
Or Connect to Data from the Browser:



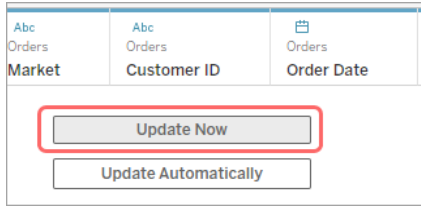
3. In the **Connect to Data** dialog box, select the **Files** tab.
4. From the **Data** subfolder of the **Student Materials** folder, drag **Global Superstore.xlsx** to the **Connect to Data** dialog box, and drop on **Drag and drop a file**.



5. On the **Data Source** tab, in the **Connections** pane, under **Sheets**, double-click the **Orders** table to add it to the canvas, or drag and drop it to the **Drag tables here** area on the canvas.



6. In the data grid, click **Update Now** to populate it.

Connect to Data from Tableau Desktop:	Or Connect to Data from the Browser:
	
<ol style="list-style-type: none"> 7. Select the Sheet 1 tab to open a new worksheet. 8. Continue to the section "Create Calculated Fields and Build a View". 	

Create Calculated Fields and Build a View

1. Click the drop-down arrow at the top of the **Data** pane, and select **Create Calculated Field**.
2. Create a calculated field, using the **Customer Name** field, to organize the customers by last name initial. Name it "First Initial of Last Name", and use the following formula:

`MID([Customer Name], FIND([Customer Name], " ") + 1, 1)`

NOTE In this formula, the **FIND** function locates the position of the space separating the first name from the last name. This position, plus one, gives us the starting position of the last name. The **MID** function, using the starting position of the last name and a substring of length one, returns the first initial of the last name.

3. Create another calculated field, using the **Customer Name** field, to show the last name and first initial. Name it "Last Name and First Initial", and use the following formula:

`MID([Customer Name], FIND([Customer Name], " ") + 1, " " + LEFT([Customer Name], 1) + ".")`

NOTE In this formula, similar to the previous formula, the **FIND** function locates the position of the space separating the first name from the last name. The **MID** function, using the starting position of the last name without an optional length argument, returns the entire last name. The **LEFT** function, with 1 as the specified number of characters, returns the first initial of the first name, along with a period. The last name is then concatenated with a comma and a space to the first initial of the first name.

4. Create the view:

Drag this field	To
First Initial of Last Name	Rows
Last Name and First Initial	Rows (to the RIGHT of First Initial of Last Name)
Sales	Text on the Marks card

5. Format **Sales** as currency with zero decimal places. **IMPORTANT** Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ In the Data pane, right-click the Sales field, select Default Properties, and select Number Format. ▪ In the Default Number Format dialog box, select Currency (Custom), set Decimal places to 0, and click OK. 	<ul style="list-style-type: none"> ▪ On the Marks card, right-click the Sales field and click Format Number. ▪ Under Number Type, select Currency, and under Decimal Places, use the downward arrow to select 0. ▪ Click outside the dialog box to close it.

6. Right-click **First Initial of Last Name** and choose **Show Filter**.
7. On the filter in the view, click the drop-down arrow, and set as a **Single Value List**.

SELF CHECK ANSWER There are three customers with last names that start with Y: Yedwab, C., Yedwab, M., and Yotov, A.

Bonus Activity

Group customer last names as follows: A-E, F-J, K-O, P-T, U-Z.

1. Duplicate the worksheet you just created: right-click the worksheet tab and choose **Duplicate**.
2. Create a calculated field named "Grouped Letters" using this formula:


```
IF[First Initial of Last Name] <= "E" THEN "A-E" // Divides customers
into 5 mostly equal groups
ELSEIF[First Initial of Last Name] <= "J" THEN "F-J"
ELSEIF[First Initial of Last Name] <= "O" THEN "K-O"
ELSEIF[First Initial of Last Name] <= "T" THEN "P-T"
ELSE "U-Z"
END
```
3. Drag the calculated field to **Rows**, and place it on top of **First Initial of Last Name** to replace it.
4. On **Filters**, right-click **First Initial of Last Name**, and then click **Remove**.
5. On **Rows**, right-click **Grouped Letters**, and choose **Show Filter**.
6. On the filter in the view, click the drop-down arrow, and set as a **Single Value List**.

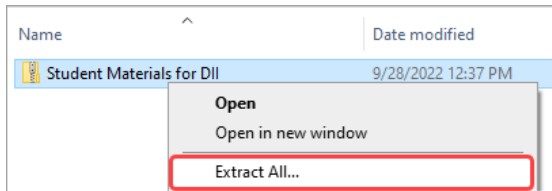
NOTE For an example of a complete solution to this practice, see **String Calculation for Customer Names Solution.twbx**.

Solution: Using a Date Calculation for a Dynamic Chart

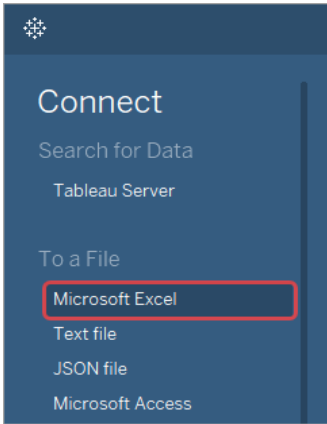
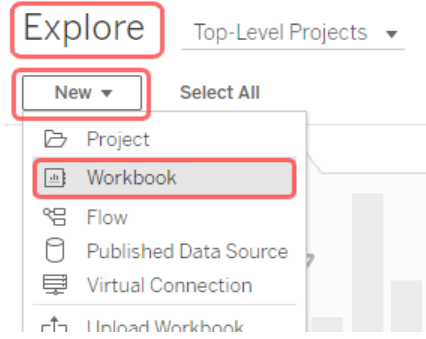
The following is a solution to "Practice: Using a Date Calculation for a Dynamic Chart" on page 6.

Connect to Data

- To begin, if you're working with a download link of a zipped **Materials** folder, right-click the folder and select **Extract All** to download the files if you have not previously done so.

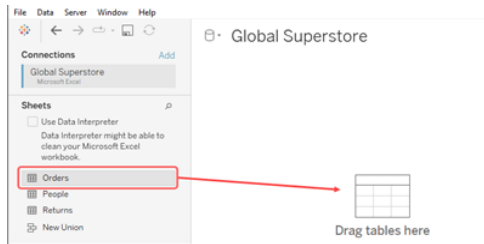


- IMPORTANT** You will now create the connection from either the Tableau Desktop application or from your browser-based site on Tableau Cloud or Tableau Server. The following table contains both sets of instructions for creating the connection.
 - For **Tableau Desktop**, follow the instructions "Connect to Data from Tableau Desktop".
 - For a browser-based site on **Tableau Cloud or Tableau Server**, follow the instructions "Connect to Data from the Browser".

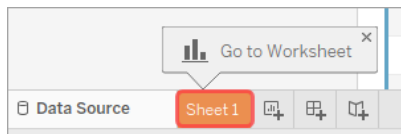
Connect to Data from Tableau Desktop:	Or Connect to Data from the Browser:
<ol style="list-style-type: none"> Open Tableau Desktop, and under Connect click Microsoft Excel.  <ol style="list-style-type: none"> In the dialog box that opens, browse to the Global Superstore.xlsx data source, located in the Data folder within the Practices folder of Student Materials and click Open. On the Data Source tab, in the 	<ol style="list-style-type: none"> In the Student Materials folder, open the Data subfolder. On the Explore page of your Tableau site, click New and then click Workbook.  <ol style="list-style-type: none"> In the Connect to Data dialog box, select the Files tab. From the Data subfolder of the Student Materials folder, drag Global Superstore.xlsx to the Connect to Data dialog box, and

Connect to Data from Tableau Desktop:

Connections pane, under **Sheets**, double-click the **Orders** table to add it to the canvas, or drag and drop it to the **Drag tables here** area on the canvas.



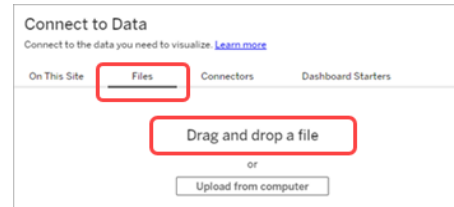
- Click **Sheet 1** to go to the worksheet.



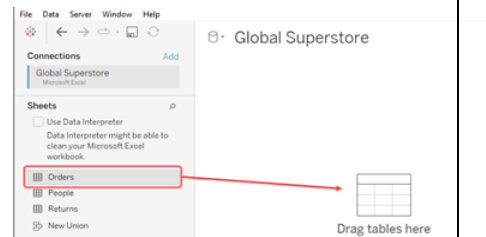
- Continue to the section "Create Calculated a Parameter and Build a View".

Or Connect to Data from the Browser:

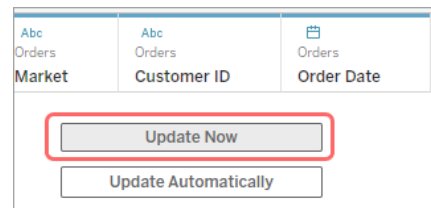
drop on **Drag and drop a file.**



- On the **Data Source** tab, in the **Connections** pane, under **Sheets**, double-click the **Orders** table to add it to the canvas, or drag and drop it to the **Drag tables here** area on the canvas.



- In the data grid, click **Update Now** to populate it.



- Select the **Sheet 1** tab to open a new worksheet.
- Continue to the section "Create a Parameter and Build a View".

Create a Parameter and Build a View

- Click the drop-down arrow at the top of the **Data** pane, and select **Create Parameter**.
- Create a parameter named "Select a Date Level", with the **Data type** of **String**.
- Choose **List** as the **Allowable Values** and click to add "Year", "Quarter", and "Month" to the **List of Values**, then click **OK**.
- Click the drop-down arrow at the top of the **Data** pane, and select **Create Calculated Field**.

5. Create a calculated field named "Date Level Calculation", using the **Order Date** field, to display the date based on the parameter value:

```
CASE[Select a Date Level]
  WHEN 'Year' THEN DATENAME('year', [Order Date])
  WHEN 'Quarter' THEN DATENAME('quarter', [Order Date])
  WHEN 'Month' THEN DATENAME('month', [Order Date])
END
```

6. Create the view:

Drag this field	To
Sales	Rows
Date Level Calculation	Columns

7. Right-click **Select a Date Level** and choose **Show Parameter**.
 8. On the parameter control in the view, click the drop-down arrow, and set as a **Single Value List**.
 9. In the **Select a Date Level** parameter control, choose **Quarter**.
 10. Right-click on the **4** field label in the view and choose **Edit alias**.
 11. Type "Q4" as the alias name and then click **OK**.
 12. Repeat this process to rename the alias names for the third, second, and first quarters to: "Q3", "Q2", and "Q1".
 13. **Tableau Desktop only:** Right-click **Date Level Calculation** in the heading and choose **Hide Field Labels for Columns**.

SELF CHECK ANSWER No, the **Month** date level does not show the same pattern of growth.

NOTE For an example of a complete solution to this practice, see **Date Calculation for Dynamic Chart Solution.twbx**.

Solution: Review - Secondary Table Calculations

The following is a solution to "Practice: Review - Secondary Table Calculations" on page 10.

View 1: Cumulative Sales by Segment

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Double-click the **Sheet 1** tab, type, "Running Total", and press the **Enter** key.
4. Use the following table to create the initial view.

Drag	To
Sales	Rows
Segment	Rows to the LEFT of Sales
Order Date	Columns

5. Click the plus sign (+) on **YEAR(Order Date)** to also show **QUARTER(Order Date)** on **Columns**.
6. Click **Bar** chart on the **Marks** card.
7. Drag another copy of **Segment** from the **Data** pane to **Color** on the **Marks** card.
8. On the **Rows** shelf, click the drop-down menu on **SUM(Sales)**, and click **Add Table Calculation**.
 - In the **Table Calculation** dialog box, click the drop-down menu for **Calculation Type** and select **Running Total**. Note that the **Compute Using** option defaults to **Table (across)** which is what we want.
 - Click **X** to close the **Table Calculation** dialog box.

SELF CHECK 1 ANSWER The cumulative sales for the consumer segment as of the end of 2018 is \$4,366,687.

SELF CHECK 2 ANSWER We can use the **Percent of Total** secondary table calculation to determine whether sales from a customer segment have grown or shrunk in importance to the company over time.

View 2: Percent of Total Sales

1. Right-click the tab of the sheet **Running Total**, and choose **Duplicate**.
2. Double-click the tab of the duplicate sheet, type, "Percent of Total", and press the **Enter** key.
3. On the **Rows** shelf, click the drop-down menu on **SUM(Sales)**, and click **Edit Table Calculation**.
4. In the **Table Calculation** dialog box, click the check box for **Add secondary calculation**.
 - Click the drop-down menu for the **Secondary Calculation Type** and select **Percent of Total**.
 - Select **Table(down)** in the **Compute Using** section.
 - Click **X** to close the **Table Calculation** dialog box.
5. Remove **Segment** from **Rows**.
6. CTRL+drag **SUM(Sales)** △ from **Rows** to **Label** on the **Marks** card.
7. Format **SUM(Sales)** △ to be a percentage with zero (0) decimal places. **IMPORTANT** Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ Right-click SUM(Sales) △ on Rows and select Format. ▪ In the Pane tab, under Default, click the Numbers drop-down menu and select Percentage. ▪ Set the percentage to have zero (0) decimal places. ▪ Click X in the Format pane to close it. 	<ul style="list-style-type: none"> ▪ On the Marks card, right-click the SUM(Sales) △ field and click Format Number. ▪ Under Number Type, select Percentage, and under Decimal Places, use the downward arrow to select 0. ▪ Click outside the dialog box to close it.

8. Right-click **SUM(Sales)** △ on **Rows** and select **Format**.
 - In the **Pane** tab, under **Default**, click the **Numbers** drop-down menu and select **Percentage**.
 - Set the percentage to have zero (0) decimal places.
 - Click **X** in the **Format** pane to close it.

SELF CHECK 3 ANSWER The secondary table calculation uses Table (down) as its scope and direction instead of using Table (across) because we want to compute the percent of a total for each segment within the same time period.

NOTE For an example of a complete solution to this practice, see **Secondary_TableCalcs_Solution.twbx**.

Solution: Using Specific Dimensions

The following is a solution to "Practice: Using Specific Dimensions" on page 12.

View One: Crosstab

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Double-click the **Sheet 1** tab, type, "Rank of States by Sales and Year", and press the **Enter** key.
4. Drag **Sales** from the **Data** pane to **Text** on the **Marks** card.
5. Drag **Country** to the **Filter** pane.
 - Click the **United States** check box.
 - Click **OK** to close the **Filter** dialog.
6. Drag **State** to **Rows**.
7. On the **Marks** card, click the drop-down menu on **SUM(Sales)**, and click **Add Table Calculation**.
 - In the **Table Calculation** dialog box, click the drop-down menu for **Calculation Type** and select **Rank**. Note that the **Compute Using** option defaults to **Table (down)** which is what we want.
 - Click **X** to close the **Table Calculation** dialog box.
8. Drag **Sales** from the **Data** pane to the view and drop it when a box highlights the **Rank** column.
9. Drag **Order Date** from the **Data** pane to **Rows** to the right of **State**.

NOTE It is being calculated for **Sales** of each **Year of Order Date** by **State**. We want the rank to be calculated for each year separately.
10. On the **Measure Values** card, click the drop-down menu on **SUM(Sales)** Δ , and click **Edit Table Calculation**.
 - In the **Compute Using** options section, click **Specific Dimensions**.
 - Make sure the **State** check box is selected.
 - If necessary, click the **Year of Order Date** check box to deselect it.
 - Click **X** to close the **Table Calculation** dialog box.

SELF CHECK 1 ANSWER California has ranked first in total sales for all four years.

View Two: Animated Bar Chart

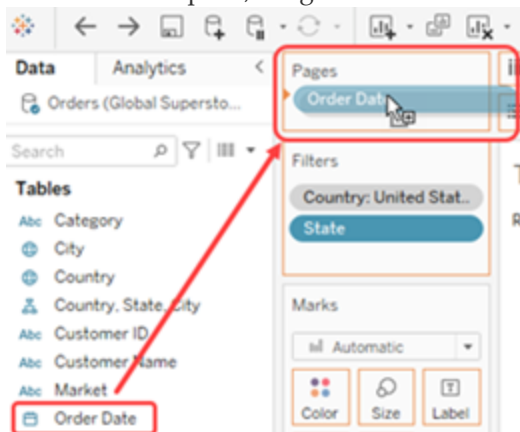
1. Create a new worksheet and name it "**Top 20 States Ranked by Sales**".
2. Drag **Country** to the **Filter** pane.
 - Click the **United States** check box.
 - Click **OK** to close the **Filter** dialog.
3. Drag **Sales** from the **Data** pane to **Columns**.

4. Drag **State**:

- To **Label** on the **Marks** card.
- To **Color** on the **Marks** card.
- To the **Filter** pane.
- In the **Filter** dialog box, complete the following actions. **IMPORTANT** Follow the directions for your environment:

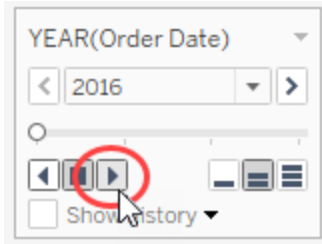
From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ Click the Top tab. ▪ Select By field, Top / 20, and Sales / Sum from the options. ▪ Click OK. 	<ul style="list-style-type: none"> ▪ Click to close the General drop-down, and open the Top/Bottom drop-down. ▪ Select By field, Top / 20, and Sales / Sum from the options. ▪ Click OK.

5. On **Filters**, right-click **Country** and select **Add to Context**.
6. From the **Data** pane, drag another instance of **Sales** to **Rows**.
7. On **Rows**, right-click **Sales** and select **Add Table Calculation**.
 - Click the **Calculation Type** drop-down list, and then click **Rank**.
 - In the drop-down list below **Rank**, keep the selection set to **Descending**.
 - In the drop-down list below **Descending**, select **Unique**.
 - Click **Specific Dimensions** in the **Compute Using** section.
 - Click the check box next to **State**.
 - Click **X** to close the dialog box.
8. On **Rows**, right-click **SUM(Sales)** Δ , and select **Discrete**.
9. On the toolbar, click the **Fit** drop-down menu, and set the view to **Fit Height**.
10. From the **Data** pane, drag **Order Date** to the **Pages** shelf.



11. On the **Format** menu, select **Animations**.
12. In the **Animations** pane, under **Selected Sheet**, do the following:
 - Under **Animation**, use the drop-down menu to select **On**.
 - Under **Duration**, use the drop-down menu to select **1.00 seconds (Slow)**.
 - Under **Style**, keep the selection set to **Simultaneous (Default)**.

- In the top right corner of the **Animations** pane, click the **X** to close it.
13. At the bottom of the **Pages** card, click the **Play** button to activate the animation.



SELF CHECK 2 ANSWER Washington State has seen its sales ranking change from 5 to 4 to 10 to 3 over time.

NOTE For an example of a complete solution to this practice, see [Using_Specific_Dimensions_Solution.twbx](#).

Solution: Customizing Table Calculations

The following is a solution to "Practice: Customizing Table Calculations" on page 14.

Create the Sum of Sales Line Chart

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. On the **Sheet 1** tab, from the **Data** pane, drag **Sales** to **Rows**.
4. From the **Data** pane, drag **Order Date** to **Columns**.
5. On **Columns**, right-click **YEAR(Order Date)** and select the **Month** date value (May 2015) format.

Create the Moving Average of Sales Line Chart

1. From the **Data** pane, drag a second instance of **Sales** to **Rows**, to the right of the existing instance.
2. On **Rows**, right-click the second instance of **SUM(Sales)**, and then click **Add Table Calculation**.
3. In the **Table Calculation** dialog box, configure the table calculation as follows:
 - Under **Calculation Type**:
 - Click the drop-down arrow to set the type to **Moving Calculation**.
 - Click the drop-down arrow to the right of **Sum, prev 2, next 0** and, in the menu that appears, click the drop-down arrow to the right of **Sum** and change it to **Average**.
 - Leave the other values at their default settings.
 - Click the **X** in the upper-right corner of the **Table Calculation** dialog box to close it.

Create a Parameter and Customize the Table Calculation

1. At the top of the **Data** pane, click the drop-down arrow and select **Create Parameter**.
2. In the **Create Parameter** dialog box, configure the parameter as follows:
 - **Name**: "Select Number of Periods"
 - **Data type**: **Integer**
 - Leave the other values at their default settings, and click **OK**.

- In the **Data** pane, under **Parameters**, right-click the **Select Number of Periods** parameter, and then click **Show Parameter**.
- Customize the table calculation. **IMPORTANT** Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> From Rows, CTRL+click and drag the second instance of SUM (Sales)△ (the one with the table calculation applied), and drop it on the Data pane to create a new calculated field. Type "Custom Moving Average" into the editable field name and press the Enter key. In the Data pane, right-click Custom Moving Average, and then click Edit. In the Calculation Editor, replace the number 2 with the parameter, leaving the negative sign as is. The resulting formula should appear as: <code>WINDOW_AVG(SUM([Sales]), -[Select Number of Periods], 0)</code> Click OK. Note that Custom Moving Average△ has automatically replaced SUM(Sales)△ on Rows. 	<ul style="list-style-type: none"> From Rows, CTRL+click and drag the second instance of SUM (Sales)△ (the one with the table calculation applied), and drop it on the Data pane to create a new calculated field. In the Data pane, right-click Calculation1, and select Rename. In the Rename Field dialog box, type "Custom Moving Average" and press OK. In the Data pane, right-click Custom Moving Average, and then click Edit. In the Calculation Editor, replace the number 2 with the parameter, leaving the negative sign as is. The resulting formula should appear as: <code>WINDOW_AVG(SUM([Sales]), -[Select Number of Periods], 0)</code> Click OK. From the Data pane, drag Custom Moving Average to Rows, placing it on top of SUM (Sales)△ (the one with the table calculation applied) to replace it.

- Type a new value for the **Select Number of Periods** parameter and press the **Enter** key. Note that the **Custom Moving Average** line chart changes.

Create the Final View

- On **Rows**, right-click **Custom Moving Average** △, and then click **Dual Axis**.
- Right-click the **Custom Moving Average** axis to the right of the view, and then click **Synchronize Axis**.
- Right-click the **Custom Moving Average** axis again, and then click **Show Header** to hide the axis.
- Right-click the **Sales** axis to the left of the view, and then click **Edit Axis**.

5. In the **Edit Axis** dialog box, edit the **Title** text to read "Sales and Custom Moving Average of Sales", and then click **X** in the upper-right corner of the dialog box to close it.
6. On the **Measure Names** legend, click the drop-down arrow to the right of its title, and then click **Title** to deselect it.

SELF CHECK 1 ANSWER With the parameter set to show the moving average of sales over the previous 6 months, July is shown to be the month that typically has the lowest average sales.

NOTE For an example of a complete solution to this practice, see **Customizing_Table_Calculations_Solution.twbx**.

Solution: Difference from Average

The following is a solution to "Practice: Difference from Average" on page 15.

Create the Initial View

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Drag **Sales** to **Rows** and **Order Date** to **Columns**.
4. Expand **YEAR(Order Date)** so that **QUARTER(Order Date)** is also on **Columns**.
5. Change the chart type to **Bar**.
6. From the **Data** pane, drag another copy of **Sales** to **Rows**.
7. On **Rows**, right-click the second **SUM(Sales)** and select **Add Table Calculation**.
8. Select **Moving Calculation** from the **Calculation Type** drop-down menu.
9. Click the **Summarize** values drop-down menu and select **Average**. Keep the **Previous**, **Next**, and **Current** default values.
10. Select **Pane (across)** in the **Compute Using** selection, and then click **X** to close the dialog box.

Customize the First Table Calculation

Customize the first table calculation to compute the difference between the actual quarterly sales and the average sales for that year. Follow the directions for your environment.

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ■ From Rows, CTRL + drag SUM (Sales) △ to the Data pane. ■ Type "Diff from Yearly Avg" into the editable field name and press the Enter key. ■ In the Data pane, right-click Diff from Yearly Avg, and then click Edit. Note how the Moving Average table calculation is 	<ul style="list-style-type: none"> ■ From Rows, CTRL + drag SUM (Sales) △ to the Data pane. ■ In the Data pane, right-click Calculation1, and select Rename. ■ In the Rename Field dialog box, type "Diff from Yearly Avg " and press OK. ■ In the Data pane, right-click Diff from Yearly Avg, and then click

From Tableau Desktop:	Or From the Browser:
<p>shown in the Calculated Field Editor using the WINDOW_AVG function with SUM([Sales]) as the expression. Also note that - 2 and 0 are the start and end offsets. This means that the average is being computed from the 2 previous rows to the current row. We want to use the first and last quarter in the current year.</p> <ul style="list-style-type: none"> ■ In the Calculation Editor, replace the -2 and 0 offsets with FIRST() and LAST() respectively. ■ We want to subtract the average sales for that year from the actual quarterly sales. Type a space in front of the WINDOW_AVG function, then type SUM([Sales]) - (minus sign) at the beginning of the formula. ■ The resulting formula should appear as: SUM([Sales]) - WINDOW_AVG (SUM([Sales]), FIRST(), LAST()) ■ Click OK. ■ Note that Diff from Yearly Avg△ has automatically replaced SUM(Sales)△ on Rows. ■ On Rows, right-click Diff from Yearly Avg△, hover over Compute Using, and ensure that Pane (across) is selected. 	<p>Edit. Note how the Moving Average table calculation is shown in the Calculated Field Editor using the WINDOW_AVG function with SUM([Sales]) as the expression. Also note that - 2 and 0 are the start and end offsets. This means that the average is being computed from the 2 previous rows to the current row. We want to use the first and last quarter in the current year.</p> <ul style="list-style-type: none"> ■ In the Calculation Editor, replace the -2 and 0 offsets with FIRST() and LAST() respectively. ■ We want to subtract the average sales for that year from the actual quarterly sales. Type a space in front of the WINDOW_AVG function, then type SUM([Sales]) - (minus sign) at the beginning of the formula ■ The resulting formula should appear as: SUM([Sales]) - WINDOW_AVG (SUM([Sales]), FIRST(), LAST()) ■ Click OK. ■ From the Data pane, drag Diff from Yearly Avg to Rows, placing it on top of SUM(Sales)△ (the one with the table calculation applied) to replace it. ■ On Rows, right-click Diff from Yearly Avg△, hover over Compute Using, and ensure that Pane (across) is selected.

Create the Second Table Calculation

1. From the **Data** pane, drag another copy of **Sales** to **Rows**, to the right of **Diff from Yearly Avg** △.
2. On **Rows**, right-click the just-added **SUM(Sales)** and select **Add Table Calculation**.

3. Select **Moving Calculation** from the **Calculation Type** drop-down menu.
4. Click the **Summarize** values drop-down menu and select **Average**. Keep the **Previous**, **Next**, and **Current** default values.
5. Keep the scope and direction as **Table (across)** in the **Compute Using** selection, and then click **X** to close the dialog box.

Customize the Second Table Calculation

Customize the second table calculation to compute the difference between the actual quarterly sales and the overall average sales. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ From Rows, CTRL + drag SUM (Sales) △ to the Data pane. This will create another new calculated field, from the table calculation, that you can customize. ▪ Type "Diff from Overall Avg" into the editable field name and press the Enter key. ▪ In the Data pane, right-click Diff from Overall Avg, and then click Edit. Note how the Moving Average table calculation is shown in the Calculated Field Editor using the WINDOW_AVG function with SUM([Sales]) as the expression. Also note that - 2 and 0 are the start and end offsets. This means that the average is being computed from the 2 previous rows to the current row. We want to use the entire table. ▪ In the Calculated Field Editor, delete the -2 and 0 offsets to use the entire table in the calculation. The formula should now appear as: WINDOW_AVG (SUM([Sales])) ▪ We want to subtract the average overall sales from the actual 	<ul style="list-style-type: none"> ▪ From Rows, CTRL + drag SUM (Sales) △ to the Data pane. This will create another new calculated field, from the table calculation, that you can customize. ▪ In the Data pane, right-click Calculation2, and select Rename. ▪ In the Rename Field dialog box, type "Diff from Overall Avg " and press OK. ▪ In the Data pane, right-click Diff from Overall Avg, and then click Edit. Note how the Moving Average table calculation is shown in the Calculated Field Editor using the WINDOW_AVG function with SUM([Sales]) as the expression. Also note that - 2 and 0 are the start and end offsets. This means that the average is being computed from the 2 previous rows to the current row. We want to use the entire table. ▪ In the Calculated Field Editor, delete the -2 and 0 offsets to use the entire table in the calculation. The formula should now appear as: WINDOW_AVG (SUM([Sales]))

From Tableau Desktop:	Or From the Browser:
<p>quarterly sales. Type a space in front of the WINDOW_AVG function, then type SUM ([Sales]) - (minus sign) at the beginning of the formula.</p> <ul style="list-style-type: none"> ▪ The resulting formula should appear as: SUM([Sales]) - WINDOW_AVG (SUM([Sales])) ▪ Click OK. ▪ Note that Diff from Overall Avg△ has automatically replaced SUM(Sales)△ on Rows. 	<ul style="list-style-type: none"> ▪ We want to subtract the average sales for that year from the actual quarterly sales. Type a space in front of the WINDOW_AVG function, then type SUM ([Sales]) - (minus sign) at the beginning of the formula ▪ The resulting formula should appear as: SUM([Sales]) - WINDOW_AVG (SUM([Sales])) ▪ Click OK. ▪ From the Data pane, drag Diff from Overall Avg to Rows, placing it on top of SUM (Sales)△ (the one with the table calculation applied) to replace it.

Format the View

1. Format the numbers. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ In the Data pane, CTRL+click the Sales field and the two calculated fields, Diff from Yearly Avg and Diff from Overall Avg, right-click and select Default Properties, and then click Number format. <ul style="list-style-type: none"> ▪ Click Currency (Custom). ▪ Set Decimal places to 0. ▪ Set Negative values to -\$1234. ▪ Set Units to Thousands (K). ▪ Click OK. 	<ul style="list-style-type: none"> ▪ On Rows, right-click the SUM (Sales) field and click Format Number. ▪ Under Number Type, select Currency, under Decimal Places, use the downward arrow to select 0, and under Units, select Thousands (K). ▪ Click outside the dialog box to close it. ▪ Repeat this process for the other two fields on Rows: Diff from Yearly Avg△ and Diff from Overall Avg△.

2. Click **All** on the **Marks** card to expand it, and then drag **Measure Names** from the **Data** pane to **Color** on the **Marks** card.
3. Click **Color** on the **Marks** card, and then click **Edit Colors**.
4. In the **Edit Colors** dialog box, confirm that the **Diff from Yearly Avg** chart is set to use orange, the **Diff from Overall Avg** chart is set to use blue, and the **Sales** chart is set to use gray.

5. Click the drop-down menu on the color legend title, and select **Title** to remove the check mark and hide the title.
6. Click the **Marks** card for **Diff from Yearly Avg**, click **Label**, and then select the **Show mark labels** check box.
7. Click the **Marks** card for **Diff from Overall Avg**, click **Label**, and then select the **Show mark labels** check box.
8. Add reference lines. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ Right-click on the Sales axis, click Add Reference Line, and select these options to set up a reference line for the average for each year: <ul style="list-style-type: none"> ▪ Line as type ▪ Scope = Per Pane ▪ Value = SUM(Sales) with an Average aggregation ▪ Label = Value ▪ Tooltip = Custom; "Yearly average =" <Value> ▪ Line = Solid, medium line width, colored orange (to match the color of its bar chart) ▪ Right-click on the Sales axis again, choose Add Reference Line, and select these options to set up a reference line for the overall average: <ul style="list-style-type: none"> ▪ Line as type ▪ Scope = Entire Table ▪ Value = Sum(Sales) with an Average aggregation ▪ Label = None ▪ Tooltip = Custom; "Overall average =" <Value> ▪ Line = Dashed, medium line width, colored blue (to match the color of its bar chart) 	<ul style="list-style-type: none"> ▪ Right-click on the Sales axis, click Add Reference Line, and select these options to set up a reference line for the average for each year: <ul style="list-style-type: none"> ▪ Line as type ▪ Scope = Pane ▪ Value = SUM(Sales) with an Average aggregation ▪ Label = Value ▪ Tooltip = Custom; "Yearly average =" <Value> ▪ Right-click on the Sales axis again, choose Add Reference Line, and select these options to set up a reference line for the overall average: <ul style="list-style-type: none"> ▪ Line as type ▪ Scope = Entire Table ▪ Value = Sum(Sales) with an Average aggregation ▪ Label = None ▪ Tooltip = Custom; "Overall average =" <Value>

9. Right-click on the **Diff from Yearly Avg** axis and select **Edit Axis**.

10. Select **Fixed** and type a **Fixed start** value of -1,000,000 and a **Fixed end** value of 1,000,000, and then click **X** to close the dialog box.
11. Repeat this process for the **Diff from Overall Avg** axis.

SELF CHECK 1 ANSWER Answers may vary. One pattern is that the first two quarters in a year tend to have a negative difference between the actual quarterly sales and the yearly averages.

SELF CHECK 2 ANSWER The **FIRST()** and **LAST()** arguments are optional here since you want to calculate the average based on the entire partition, which varies for the scope of the two calculated fields (pane for yearly average, and table for overall average). If you omit **FIRST()** and **LAST()** from a window calc, then, by default, it will use the entire partition. However, if "compute using" was set to pane across, it would use the current year. If "compute using" was set to table across, it would use all of the years.

NOTE For an example of a complete solution to this practice, see **Difference_from_Average_Solution.twbx**.

Solution: Weighted Average Sales

The following is a solution to "Practice: Weighted Average Sales" on page 18.

Create the Initial View

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Drag **Sales** to **Columns**, and **Sub-Category** to **Rows**.
4. Right-click **SUM(Sales)**, select **Measure (SUM)**, and then click **Average**.

Calculate a Weighting Factor Based on Quantity

1. On the **Analysis** menu, click **Create Calculated Field**.
2. In the **Calculated Field** dialog box, name the calculation "Weighting Factor by Quantity".
3. Enter the following formula in the calculation editor.

`SUM([Quantity]) / WINDOW_SUM(SUM([Quantity]), FIRST(), LAST())`

This customized table calculation will compute a weighting factor comparing the quantity ordered for each product with the quantity ordered for all of the product sub-categories.

Calculate the Weighted Average Sales

1. On the **Analysis** menu, click **Create Calculated Field**.
2. In the **Calculated Field** dialog box, name the calculation "Weighted Average Sales".
3. Enter the following formula in the calculation editor.

`AVG([Sales]) * [Weighting Factor by Quantity]`

4. From the **Data** pane:
 - Drag **Weighted Average Sales** to **Columns**, to the RIGHT of **AVG(Sales)**.
 - Drag **Measure Names** to **Color** on the **Marks** card.

SELF CHECK 1 ANSWER The relative bar lengths for the weighted and unweighted average sales of tables are so different because the average sales were high, but a small number of tables were sold compared to the quantity sold of other products.

SELF CHECK 2 ANSWER The relative bar lengths for the weighted and unweighted average sales of phones are so different because the average sales were in the middle of the range of all products, but a large number of phones were sold compared to the quantity sold of other products.

SELF CHECK 3 ANSWER The FIRST() and LAST() arguments are optional here. If you omit FIRST() and LAST() from a window calc, then by default it will use the entire partition.

NOTE For an example of a complete solution to this practice, see **Weighted_Average_Solution.twbx**.

Solution: Filtering Table Calculations

The following is a solution to "Practice: Filtering Table Calculations" on page 19.

View 1: Filtered Table Calculations

1. Open **Filter Table Calculations Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
 - For specific instructions for opening a .twbx file in Tableau Desktop, see "Working in the Desktop Application" on page 123
 - "Working in the Browser" on page 127
2. On the **Difference in Sales** tab, right-click **Quarter** on **Columns** and select **Show Filter**.
3. In the **Quarter** filter in the view, click **Q1** to clear the check box for the first quarter.

SELF CHECK 1 ANSWER The **Difference in Sales** from the previous quarter is blank in the **Q2** column because the underlying data from the first quarter has been filtered from the query results so there is no longer a **Q1** value to base the calculation on.

4. In the **Quarter** filter in the view, click **Q1** again to select the check box for the first quarter.
5. In the **Data** pane, right-click **Quarter** and select **Create Calculated Field**.
6. In the **Calculated Field Editor**, name the calculated field "Quarter Table Calculation Filter" and enter the formula:


```
LOOKUP (MIN ([Quarter]), 0)
```
7. Drag **Quarter Table Calculation Filter** to the **Filters** shelf.
8. In the **Filters** dialog box, click **All** to select **Q1**, **Q2**, **Q3**, and **Q4**, then click **OK**.
9. Right-click **Quarter Table Calculation Filter** on the **Filters** shelf and select **Show Filter**.
10. In the **Quarter Table Calculation Filter** in the view, click **Q1** to clear the check box for the first quarter.

SELF CHECK 2 ANSWER The **Difference in Sales** from the previous quarter is now showing in the **Q2** column because, even though the **Q1** results do not show in the view, the underlying **Q1** data has not been filtered from the query results that the table calculation is based on.

View 2: Filtered Totals

1. Right-click the tab of the **Difference in Sales** sheet and choose **Duplicate**.
2. Double-click the tab of the duplicated sheet and name it "Filtered Totals".
3. From the **Analysis** menu, click **Totals** and then select **Show Column Grand Totals**.
4. In the view, click the drop-down menu in the **SUM(Sales)** color legend and select **Edit Colors**.
5. Click the check box to **Include Totals** in the color encoding, then click **OK**.
6. Repeat this process for the **Difference in SUM(Sales)** color legend.
7. In the **Quarter Table Calculation Filter** in the view, click **Q1** and **Q2** to clear the check boxes for the first and second quarters.

SELF CHECK 3 ANSWER The totals are still showing in the view for **Q1** and **Q2** because the table calculation filter does not apply to totals, by default.

8. Right-click **Quarter Table Calculation Filter** on the **Filters** shelf and select **Apply to Totals**.

NOTE For an example of a complete solution to this practice, see **Filter Table Calculations Solution.twbx**.

Solution: Pareto Chart

The following is a solution to "Practice: Pareto Chart" on page 21.

Part 1: Basic Pareto

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Double-click the **Sheet 1** tab, type, "Basic Pareto", and press the **Enter** key.
4. From the **Data** pane:
 - Drag **Profit** to **Rows**.
 - Drag **Customer ID** to **Columns**.
5. On **Columns**, right-click **Customer ID**, and then click **Sort**.
6. Use the steps below to complete the **Sort** dialog box.
 - **Sort by:** Field.
 - **Sort order:** Descending.
 - Set the drop-down lists to **Profit** and **Sum**.
 - Click **X** to close the **Sort** dialog box.
7. On the toolbar, use the drop-down to change the window fit from **Standard** to **Entire View**.
8. On **Rows**, right-click **SUM(Profit)**, and then click **Add Table Calculation**.
9. Use the steps below to complete the **Table Calculation** dialog box.
 - **Calculation Type:** Running Total, Sum
 - **Compute Using:** Specific Dimensions, ensure **Customer ID** is checked.
 - Select **Add secondary calculation**.
 - **Secondary Calculation Type:** Percent of Total
 - **Compute Using:** Specific Dimensions, ensure **Customer ID** is checked.
 - Click the **X** to close the dialog box.

Part 2: Intermediate Pareto

1. Right-click the **Basic Pareto** worksheet tab, and then click **Duplicate**.
2. Double-click the new worksheet tab, type "Intermediate Pareto", and press the **Enter** key.
3. From **Columns**, CTRL + drag a copy of **Customer ID** to **Detail** on the **Marks** card.
4. On **Columns**:
 - Right-click **Customer ID**, select **Measure**, and then click **Count (Distinct)**.
 - Right-click **Customer ID** again, and then click **Add Table Calculation** to open the **Table Calculation** dialog box.
 - Using the steps below, complete the **Table Calculation** dialog box:
 - **Calculation Type: Running Total, Sum**
 - **Compute Using: Specific Dimensions**, ensure **Customer ID** is checked.
 - Select **Add secondary calculation**.
 - **Secondary Calculation Type: Percent of Total**
 - **Compute Using: Specific Dimensions**, ensure **Customer ID** is checked.
 - Click the **X** to close the dialog box.
5. On the **Marks** card:
 - Click the mark type drop-down list, and change it to **Bar**.
 - Click **Size**, and then drag the slider to the smallest setting. **Tableau Desktop** only: Ensure **Manual** is selected.
6. From the **Data** pane, drag **Profit** to **Color** on the **Marks** card.
7. Right-click the axis for **% of Total Running Sum of Profit**, and then click **Add Reference Line**.
Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ Line as type ▪ Scope = Entire Table ▪ Under Line, change the right-most Value drop-down list to Constant. ▪ Set the Value field to 0.80. ▪ Label = Value ▪ Line = Solid, thin line width, colored gray ▪ Fill Above and Fill Below = None ▪ Click OK. 	<ul style="list-style-type: none"> ▪ Line as type ▪ Scope = Table ▪ Under Line, change the right-most Value drop-down list to Constant. ▪ Set the Value field to 0.80. ▪ Label = Value ▪ Click the X to close the dialog box.

8. Right-click the axis for **% of Total Running Sum of Distinct count of Customer ID**, and then click **Add Reference Line**. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ Line as type ▪ Scope = Entire Table 	<ul style="list-style-type: none"> ▪ Line as type ▪ Scope = Table

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> Under Line, change the right-most Value drop-down list to Constant. Set the Value field to 0.20. Label = Value Line = Solid, thin line width, colored gray Fill Above and Fill Below = None Click OK. 	<ul style="list-style-type: none"> Under Line, change the right-most Value drop-down list to Constant. Set the Value field to 0.20. Label = Value Click the X to close the dialog box.

Part 3: Complete Pareto

- Right-click the **Intermediate Pareto** worksheet tab, and then click **Duplicate**.
- Double-click the new worksheet tab, click **Rename Sheet**, type "Complete Pareto", and press the **Enter** key.
- From the **Data** pane, drag **Profit** to the **Rows** shelf and place it to the right of the existing **SUM (Profit)Δ**.
- On **Rows**, right-click the new **SUM(Profit)**, and then click **Dual Axis**. The new **Profit** axis now appears on the right side.
- Right-click on the **% Total Running Sum of Profit** axis, select **Mark Type**, and then click **Line**.
- Right-click the **% Total Running Sum of Profit** axis again, and then click **Move marks to front**.
- Make sure **SUM(Profit)Δ** is still selected on the **Marks** card.
- On the **Marks** card:
 - Right-click the **SUM(Profit)** instance that is currently controlling the color, and then click **Remove**.
 - Click **Color**, and then click black.
 - Click **Size**, and then increase the size.
- Right-click the **% of Total Running Sum of Profit** axis, and click **Edit Axis**.
 - In the **Edit Axis** dialog box, on the **General** tab, under **Axis Titles**, change the **Title** field to "% of Total Profit".
 - Click **X** to close the dialog box.
- Right-click the **% of Total Running Sum of Distinct count of Customer ID** axis, and click **Edit Axis**.
 - In the **Edit Axis** dialog box, on the **General** tab, under **Axis Titles**, change the **Title** field to "% of Total Customers".
 - Click **X** to close the dialog box.

NOTE For an example of a complete solution to this practice, see **Pareto Chart Solution.twbx**.

Solution: Customer Order Frequency (FIXED)

The following is a solution to "Practice: Customer Order Frequency (FIXED)" on page 26.

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Right-click and drag **Order ID** to **Rows**, select **CNTD (Order ID)** from the dialog box and click **OK**.
4. Drag **Customer ID** to **Columns**.
5. Right-click **Customer ID**, click **Sort**, select **Descending**, and under **Field** select **Order ID** and **Count (Distinct)**.
6. Name the sheet "Orders per Customer".
7. Click the **New Sheet** button to create a new sheet.
8. Click the arrow at the top of the **Data** pane, select **Create Calculated Field**, create the following LOD expression `{FIXED[Customer ID]:COUNTD([Order ID])}` and name it "Orders per Customer".
9. Convert **Orders per Customer** from a measure to a dimension.
10. Drag **Orders per Customer** from the **Data** pane to **Columns**.
11. Right-click and drag **Customer ID** to **Rows**, select **CNTD (Customer ID)** from the dialog box and click **OK**.
12. Ctrl+drag **CNTD(Customer ID)** from **Rows** to **Label** on the **Marks** card.
13. Name the sheet "Count of Orders Per Customer".

SELF CHECK 1 ANSWER How many customers made exactly 12 purchases? 61

SELF CHECK 2 ANSWER What is the most common number of purchases made by customers? 5

SELF CHECK 3 ANSWER How many customers made the most common number of purchases? 652

NOTE For an example of a complete solution to this practice, see **Customer Order Frequency FIXED Solution.twbx**.

Solution: Country and Customer Sales (INCLUDE)

The following is a solution to "Practice: Country and Customer Sales (INCLUDE)" on page 27.

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Drag **Sales** to **Columns**, and drag **Country** to **Rows**.
4. Drag **Market** to **Filters** and filter on **APAC**.
5. Right-click on **Country**, click **Sort**, and click **Descending** by **Sum of Sales**.
6. On the **Marks** card, click **Label** and then check **Show mark labels**.
7. Click the arrow at the top of the **Data** pane, select **Create Calculated Field**, and create an LOD expression called "Sales per Customer" as follows: `{INCLUDE[Customer ID]:SUM([Sales])}`
8. Drag **Sales per Customer** to **Columns**, to the right of **SUM(Sales)**.

9. Change the aggregation for **Sales per Customer** to an average. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> On Columns, right-click Sales per Customer. Point to Measure (SUM), and then click Average. 	<ol style="list-style-type: none"> On Columns, right-click Sales per Customer. Point to Measure, and then click Average.

10. Click the arrow at the top of the **Data** pane, select **Create Calculated Field**, and create an LOD expression called "Profit per Customer" as follows: `{INCLUDE [Customer ID]:SUM([Profit])}`
11. Drag **Profit per Customer** to **Columns** to the right of **AVG(Sales per Customer)**, and then change the aggregation to **Average**.
12. On the **Marks** card, click **AVG(Sales per Customer)** to expand it.
13. CTRL+drag a copy of **AVG(Profit per Customer)** from **Columns** to **Color** on the **Marks** card.
14. On the toolbar, click the **Fit** drop-down and change to **Fit Height**.

SELF CHECK 1 ANSWER Which country had the most sales? Australia

SELF CHECK 2 ANSWER Which country had the largest average sales by customer? Taiwan

SELF CHECK 3 ANSWER How many countries had customers whose average orders were unprofitable? 8

SELF CHECK 4 ANSWER Why might a FIXED LOD expression return incorrect results in this scenario? Some customers made purchases in more than one country. Using a FIXED expression would return purchase amounts for all countries where a customer made a purchase. INCLUDE limits the results to the countries in the view.

NOTE For an example of a complete solution to this practice, see **Country and Customer Sales INCLUDE Solution.twbx**.

Solution: Country and Regional Sales (EXCLUDE)

The following is a solution to "Practice: Country and Regional Sales (EXCLUDE)" on page 28.

- Connect to **Global Superstore.xlsx**.
- On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
- Drag **Sales** to **Columns**, and drag **Region** to **Rows**.
- Drag **Country** to **Rows**, to the right of **Region**.
- Drag **Market** to **Filters**, select **EMEA**, and then click **OK**.
- Click **Label** on the **Marks** card and then select **Show mark labels**.
- Click the arrow at the top of the **Data** pane, select **Create Calculated Field**, and then create an LOD expression called "Exclude Country from Sales" that computes the sales in the view excluding country: `{EXCLUDE [Country]:SUM([Sales])}`

8. Click the arrow at the top of the **Data** pane, select **Create Calculated Field**, name the field "Country/Regional Sales" and use this calculation: `SUM([Sales])/SUM([Exclude Country from Sales])`. This field compares the sales of a country in the view to the value of the EXCLUDE LOD expression.
9. Drag **Country/Regional Sales** to **Columns**, to the right of **SUM(Sales)**.
10. In the **Data** pane, click the arrow to the right of **Country/Regional Sales**, point to **Default Properties**, and then click **Number format**.
11. Change **Country/Regional Sales** to a percentage. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ In the Data pane, right-click the Country/Regional Sales field and select Default Properties, and then click Number format. ▪ Click Percentage. ▪ Click OK. 	<ul style="list-style-type: none"> ▪ On Columns, right-click the Country/Regional Sales field and click Format Number. ▪ Under Number Type, select Percentage. ▪ Click outside the dialog box to close it.

12. Right-click the **Country** field on **Rows**, click **Sort**, click **Field**, click **Descending**, select **Country/Regional Sales**, and then select **Custom**. Click **X** to close the **Sort [Country]** dialog box.

SELF CHECK 1 ANSWER In the entire EMEA market, which two countries contributed the highest percentage of sales to their respective regions, and what were the values? United Kingdom (84.49%) in the North region and France (49.92%) in the Central region contributed the highest percentage of sales to their respective regions.

SELF CHECK 2 ANSWER How might you show **Country/Regional Sales** as a percentage using a method other than changing its number format? Set a **Percent of Total Quick Table Calculation** on the **AGG(Country/Regional Sales)** field in **Columns**.

NOTE For an example of a complete solution to this practice, see **Country and Regional Sales EXCLUDE Solution.twbx**.

Solution: Average Shipping Costs (Nested)

The following is a solution to "Practice: Average Shipping Costs (Nested)" on page 30.

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. From the **Data** pane:
 - Drag **Market** to **Rows**.
 - Drag **Region** to **Rows**, to the right of **Market**.
4. Click the arrow at the top of the **Data** pane, click **Create Calculated Field**, and then create an LOD expression called "Largest Order Shipping Cost by Country" as follows:

```
{FIXED [Country]:MAX({FIXED [Order ID]:SUM([Shipping Cost]))}}
```

5. Drag **Largest Order Shipping Cost by Country** to **Columns**.
6. Change the aggregation of **Largest Order Shipping Cost by Country** to an average. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ On Columns, right-click Largest Order Shipping Cost by Country. ▪ Point to Measure (SUM), and then click Average. 	<ul style="list-style-type: none"> ▪ On Columns, right-click Largest Order Shipping Cost by Country. ▪ Point to Measure, and then click Average.

7. Ctrl+drag a copy of **AVG(Largest Order Shipping Cost by Country)** from **Columns** to **Label** on the **Marks** card.
8. Change the number format of **Largest Order Shipping Cost by Country** to display as currency with two decimal places. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ On the Marks card, right-click the AVG(Largest Order Shipping Cost by Country) field, and click Format. ▪ In the Format pane, under Default, click the Numbers drop-down and click Currency (Standard). ▪ Click the X to close the Format pane. 	<ul style="list-style-type: none"> ▪ On the Marks card, right-click the AVG(Largest Order Shipping Cost by Country) field, and click Format Number. ▪ Under Number Type, select Currency. ▪ Click outside the dialog box to close it.

9. On the toolbar, use the drop-down to change the window fit to **Entire View**.

SELF CHECK ANSWER Why are there identical values for some regions in the USCA market? The Central, East, South, and West regions in USCA all pertain to a single country - the United States.

NOTE For an example of a complete solution to this practice, see **Average Shipping Costs Nested Solution.twbx**.

Solution: Choosing Calculation Types

The following is a solution to "Practice: Choosing Calculation Types" on page 31.

1. **Sales Difference Bar Chart:** All the required data is present in the view, and the view type is suitable, so a **Difference From** table calculation can be used here for the bar chart.
2. **Sales Difference Highlight Table:** All the required data is present in the view, but the view type is not suitable for a table calculation, because using **Difference From** would generate an empty row in the crosstab. In this solution, three calculated fields are used to build the view: one for sum of 2017 Sales, one for sum of 2018 Sales, and one to compute the difference between the two.
3. **Percentage of Unprofitable Products:** This example uses both an LOD expression and calculated fields. **Profit Including Product** is an LOD expression that returns the sum of profit for each product name. **Products with Negative Profit** is a calculation that finds the results of the LOD expression that are less than zero in order to identify only the products associated with a negative profit. **Percent Unprofitable Products** calculates the distinct count of **Products with Negative Profit** divided by the distinct count of **Product Name**, with the result placed on color and aggregated as a percentage.
4. **Top Ten Countries by Sales:** This is a rank of items in the view, so a table calculation is required. Table calculations are the only solution for problems that require ranking, recursion (for example, cumulative totals), moving calculations (for example, rolling averages), or inter-row calculations (for example, period-vs.-period calculations).

NOTE: For an example of a complete example solution to this practice, see **Choosing Calculation Types Solution.twbx**.

Solution: Creating a Chart with Sparklines

The following is a solution to "Practice: Creating a Chart with Sparklines" on page 36.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.

1. From Tableau Desktop, connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. On the **Sheet 1**, tab, from the **Data** pane:
 - Drag **Sales** to **Rows**.
 - Drag **Country** to **Rows**, to the left of **SUM(Sales)**.
 - Drag **Market** to **Filters**.
 - In the **Filter [Market]** dialog box, choose **All**, and then click **OK**.
4. Right-click on the **Market** filter and click **Show Filter**.
5. On the **Market** filter in the view, click the drop-down arrow, and then click **Single Value (dropdown)**.

6. From the **Data** pane:
 - Drag **Order Date** to **Filters**.
 - In the **Filter Field [Order Date]** dialog box, choose **Years**, and then click **Next**.
 - On the **General** tab, select the check box next to **2019**, and then click **OK**.
 - Drag **Order Date** to **Columns**.
7. On **Columns**:
 - Click the plus (+) sign on **Order Date** until the **Month** discrete date part displays.
 - Right-click **YEAR(Order Date)**, and then click **Remove**.
 - Right-click **QUARTER(Order Date)**, and then click **Remove**.

MONTH(Order Date) should be the only field remaining on **Columns**.
8. On **Rows**, right-click **SUM(Sales)**, and make sure **Show Header** has a check next to it.
9. On the visualization, right-click any **Sales** axis, and then click **Edit Axis**.
10. In the **Edit Axis [Sales]** dialog box:
 - On the **General** tab, select **Independent axis ranges for each row or column**.
 - Click **X** to close the dialog box.
11. On **Rows**, right-click **SUM(Sales)**, and then click **Format**.
12. Under **Format SUM (Sales)**:
 - Click the **Pane** tab.
 - Under **Special Values**, set the **Marks** drop-down list to **Show at Default Value**.
 - At the top of the **Format** menu, click the **Lines** icon.
 - Under **Lines**, on the **Sheet** tab, set the **Grid Lines** and **Zero Lines** drop-down lists to **None**.
 - Click the **X** in the upper-right corner of the **Format** menu to close it.
13. On the **Analysis** menu, click **Create Calculated Field**, and use the following steps to complete the dialog box.
 - Name the calculated field "Last Sales".
 - In the **Formula** text box, enter the following formula:


```
IF LAST()=0 THEN ZN(SUM([Sales])) END
```
 - Click **OK**.
14. From the **Data** pane, drag **Last Sales** to **Rows**, placing it to the right of **SUM(Sales)**.
15. On **Rows**, right-click **Last Sales**△, and then click **Dual Axis**.
16. On the visualization:
 - Right-click on any **Last Sales** axis, and then click **Synchronize Axis**.
 - Right-click on any **Last Sales** axis, and then click **Show Header** to clear it.
17. On **Rows**, right-click **Last Sales**△, and then click **Format**.
 - On the **Pane** tab, under **Special Values**, set the **Marks** drop-down list to **Hide (Break Lines)**.
 - Click the **X** in the upper-right corner of the **Format** menu to close it.
18. On the **Analysis** menu, click **Create Calculated Field**, and use the following steps to complete the dialog box.
 - Name the calculated field "Current Sales".
 - In the **Formula** text box, enter the following formula:


```
ZN(LOOKUP(SUM([Sales]), LAST()))
```
 - Click **OK**.
19. From the **Data** pane, drag **Current Sales** to **Rows**, and place it between **Country** and **SUM(Sales)**.

20. On **Rows**:
 - Right-click **Current Sales**△, and then click **Discrete**.
 - Right-click **Current Sales**△, and then click **Format**. In the **Format** pane:
 - On the **Header** tab, under **Default**, click the **Numbers** drop-down list, and then click **Currency (Standard)**.
 - Under **Alignment**, click the drop-down list and under **Horizontal**, select the **Right** icon.
 - Click the **X** to close the **Format** pane.
21. On **Rows**, right-click **SUM(Sales)**, and then click **Show Header** to clear it.
22. Change the height of the rows by dragging the border of a row to create shorter rows.
23. Use the keyboard shortcut **CTRL+Left Arrow** (**Command + Control + Left Arrow** on a Mac) to narrow the column for the lines.
24. Click **All** on the **Marks** card, and then click **Color**.
25. On the **Color** dialog box click **Edit Colors**.
26. In the **Edit Colors [Measure Names]** dialog box:
 - Click **Last Sales** under **Select Data Item** and then click the orange tile below the drop-down list.
 - Click **Sales** under **Select Data Item** and then click the blue tile below the drop-down list.
 - Click **OK**.
27. Right-click on the title in the view, and then click **Edit Title**.
28. Change the title to read "2019 Sales for Countries in the <Market> Market", and then click **OK**.

NOTE For an example of a complete solution to this practice, see **Sparklines_Solution.twbx**.

Solution: Creating a Control Chart

The following is a solution to "Practice: Creating a Control Chart" on page 38.

Directions: Create the initial view

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. On the **Sheet 1** tab, from the **Data** pane:
 - Drag **Sales** to **Rows**.
 - Drag **Order Date** to columns.
 - Drag a second instance of **Order Date** to **Columns**, right-click the field, and select the **Month (May)** date part format.

Create the average line and control limits

1. On the **Analytics** pane, under **Custom**, drag a **Reference Line** to **Pane** and in the **Reference Line** dialog box, set the following options:
 - **Value:** **SUM (Sales)** set to **Average**.
 - **Label:** **None**
 - **Tableau Desktop only:** **Line:** Gray dashed line.
2. Click the arrow at the top of the **Data** pane, select **Create Calculated Field**. Name the field "Upper Control Limit" and enter the following in the editor text box:

```
WINDOW_AVG(SUM([Sales])) + WINDOW_STDEV(SUM([Sales]))
```

3. On the **Data** pane, right-click the **Upper Control Limit** field, and click **Duplicate**.
4. Right-click the duplicate field, click **Rename**, and type "Lower Control Limit". Next, in Tableau Desktop, press the **Enter** key in Tableau Desktop, or in the browser, click **OK**.
5. Right-click **Lower Control Limit**, click **Edit**, and in the Calculated Field editor, edit the field as follows:


```
WINDOW_AVG(SUM([Sales])) - WINDOW_STDEV(SUM([Sales]))
```
6. Drag **Upper Control Limit** and **Lower Control Limit** to **Detail** on the **Marks** card.
7. On the **Analytics** pane, under **Custom**, drag a **Reference Band** to **Pane** and in the **Reference Band** dialog box, set the following options:
 - **Band from:** **Lower Control Limit**△ set to **Minimum**.
 - **Band to:** **Upper Control Limit**△ set to **Maximum**.
 - **Label:** **None** on both.
 - **Tableau Desktop only:** **Line:** Red dashed line.
 - **Tableau Desktop only:** **Fill:** Light Gray.
8. On the **Marks** card, do the following:
 - Click the drop-down menu on **Lower Control Limit**△, click **Compute Using**, and change to **Pane (across)**.
 - Click the drop-down menu on **Upper Control Limit**△, click **Compute Using**, and change to **Pane (across)**.

Create a key performance indicator (KPI)

1. From the **Data** pane, drag another instance of **Sales** to **Rows**, to the right of **SUM(Sales)**.
2. Expand **SUM(Sales)(2)** on the **Marks** card, remove the **Lower Control Limit** and **Upper Control Limit** fields, and on the drop-down menu, select the mark type **Circle**.
3. Right-click the second **Sales** axis and click **Dual Axis**.
4. Right-click the second **Sales** axis again and click **Synchronize Axis**.
5. Right-click the second **Sales** axis again and clear the check next to **Show Header**.
6. Click the arrow at the top of the **Data** pane, and click **Create Calculated Field**. Name the field "KPI" and enter the following information:


```
IF SUM([Sales]) > [Upper Control Limit] or SUM([Sales]) < [Lower Control Limit] THEN "Out of Control" ELSE "In Control" END
```
7. Expand **SUM(Sales)(2)** on the **Marks** card and from the **Data** pane, drag **KPI** to **Color**.
8. On the **Marks** card, click **Size** and move the slider to adjust circle sizes if desired.
9. **Tableau Desktop only:** On the **AGG(KPI)** legend, click the drop-down menu, click **Edit title**, and type "KPI".

Create a parameter to adjust standard deviation

1. Click the arrow at the top of the **Data** pane, and select **Create Parameter**.
2. Name the parameter "Choose Standard Deviation" and set the following values:
 - **Data Type:** Integer
 - **Current value:** 1
 - **Value when workbook opens:** Current value
 - **Display format:** Automatic
 - **Allowable values:** Range

- **Min:** 0
 - **Max:** 3
 - **Step size:** 1
3. In the **Data** pane, do the following:
 - Right-click **Upper Control Limit** and in the Calculated Field editor, edit as follows:

$$\text{WINDOW_AVG}(\text{SUM}([\text{Sales}])) + \text{WINDOW_STDEV}(\text{SUM}([\text{Sales}])) * [\text{Choose standard Deviation}]$$
 - Right-click **Lower Control Limit** and in the Calculated Field editor, edit as follows:

$$\text{WINDOW_AVG}(\text{SUM}([\text{Sales}])) - \text{WINDOW_STDEV}(\text{SUM}([\text{Sales}])) * [\text{Choose standard Deviation}]$$
 4. Right-click **Choose Standard Deviation** and click **Show Parameter**.
 5. Adjust the slider on the control and observe the results.

SELF CHECK 1 ANSWER When standard deviation is set to 1, eleven months are above the control limit.

SELF CHECK 2 ANSWER Seven months are below the control limit.

NOTE For an example of a complete solution to this practice, see **Control Chart Solution.twbx**.

Solution: Creating a Bump Chart

The following is a solution to "Practice: Creating a Bump Chart" on page 40.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.

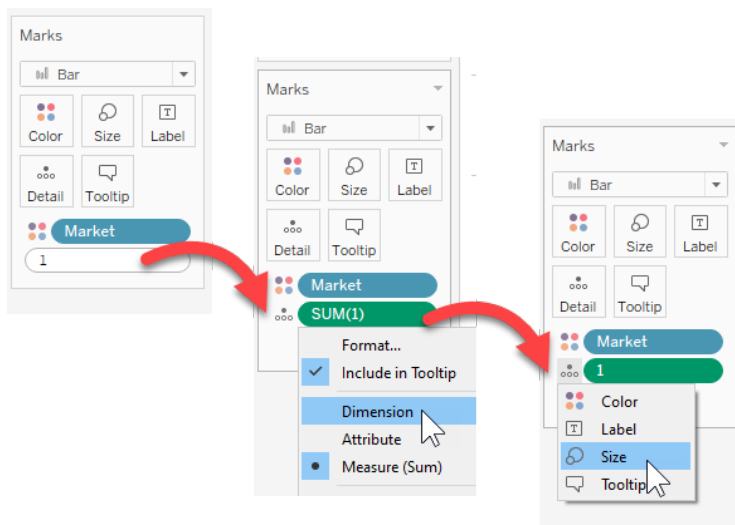
Create the Bump Chart

1. From Tableau Desktop, connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Name the first worksheet **Bump Chart**.
4. From the **Data** pane:
 - Drag **Sales** to **Rows**.
 - Drag **Order Date** to **Columns**.
5. On **Columns**, right-click **YEAR (Order Date)** and select the **Month (May)** date part format.
6. From the **Data** pane:
 - Drag **Market** to **Color** on the **Marks** card.
 - Drag **Order Date** to **Filters**, click **Years**, click **Next**, select **2017**, and click **OK**.
7. On **Rows**, right-click **SUM (Sales)**, click **Add Table Calculation**, and then use the following steps to complete the dialog box.
8. Under **Calculation Type** set the following values:
 - First drop-down list: select **Rank**
 - Second drop down list: select **Descending**
 - Third drop down list: select **Competition (1, 2, 2, 4)**

9. Under **Compute Using** set the following values:
 - In the first list select **Specific Dimension**
 - In the second list select **Market** and ensure **Month of Order Date** is not selected.
 - Click **X** to close the dialog box.
10. Right-click the **Rank of Sales** axis, choose **Edit Axis**, and use the following steps to complete the dialog box.
 - On the **General** tab, under **Range**, click **Fixed**.
 - Change the **Fixed start** text box to **1**.
 - Change the **Fixed end** text box to **4**.
 - Under **Scale**, check the box next to **Reversed**.
 - Click **X** to close dialog box.
11. On **Rows**, right-click **SUM (Sales)△**, and choose **Discrete**.
12. On the **Marks** card, click the mark type drop-down list and change the mark type from **Automatic** to **Line**.
13. Click and drag the bottom border of the view to adjust the size as needed.

Convert the Bump Chart to a Highlight Table View

1. Right-click the tab for the **Bump Chart** worksheet, and choose **Duplicate as Crosstab**.
2. Name the new worksheet **Highlight Table**.
3. On the new crosstab sheet, from **Rows**, drag **Market** to **Color** on the **Marks** card.
4. On the **Marks** card, click the mark type drop-down list and change the mark type from **Automatic** to **Bar**.
5. On the **Marks** card, double-click the empty space below the existing field to open the ad-hoc calculation editor, and then do the following:
 - Type the number **1**.
 - Press the **Enter** key to close the ad-hoc editor.
 - Open the drop-down menu for the new **SUM(1)** field and select **Dimension**.
 - Click the icon next to the new **1** field and select **Size** from the drop-down.



6. From the **Data** pane, drag **Sales** to **Label** on the **Marks** card.

7. Drag the bottom edge of the view to adjust the overall size.
8. Click **Size** on the **Marks** card and adjust the slider to enlarge the marks to fill the view.

Bonus: Create a Market Button Worksheet

1. Create a new worksheet named **Markets**.
2. From the **Data** pane:
 - Drag **Market** to **Columns**.
 - Drag another instance of **Market** to **Text** on the **Marks** card.
3. On the **Marks** card, click the mark type drop-down list and change the mark type from **Automatic** to **Circle**.
4. From the **Data** pane, drag another instance of **Market** to **Color** on the **Marks** card.
5. If the field labels are showing on the view, right-click the **Market** field label, and choose **Hide Field Labels for Columns**.
6. If the header row is showing, on **Columns**, right-click **Market** on **Columns**, and choose **Show Header** to deactivate the check mark.
7. On the **Marks** card:
 - Click **Label**, and set the **Horizontal Alignment** to centered.
 - Click **Size** and move the slider to increase the size of the circles. (**HINT**: You can also drag the column and row edges to enlarge the circles.)
8. Under **Format**, click **Borders**, and select the **Rows** tab.
9. Under **Row Divider**, set the **Pane** drop-down list to **None**.
10. On the **Marks** card, click **Color**, and set the **Border** drop-down list to a dark gray border.
11. Double-click the title to edit it.
12. Delete the text in the **Edit Title** dialog box, and type "Hover to view rank trends in sales.", and click **OK**.

Bonus: Build the Dashboard

1. Click the new dashboard tab and name the new dashboard "Bump Chart and Highlight Table".
2. Drag the worksheets onto the dashboard, with **Markets** at the top, **Bump Chart** in the middle, and **Highlight Table** on the bottom.
3. Adjust the borders between the sheets on the dashboard as needed.
4. Click the **Market** color legend, and then click the **X** to remove it from the dashboard. Do the same for the ad-hoc field1 size legend.
5. Click the **Bump Chart**, click the drop down arrow, and then deselect **Title** to remove it. Do the same for the **Highlight Table** sheet.
6. Click each sheet, click the drop-down arrow, point to **Fit**, and then select **Fit Width**.
7. On the **Dashboard** menu, click **Actions**.
8. If any actions are listed, select them, and click **Remove** to delete them.
9. Click **Add Action**, choose **Highlight**, and use the following steps to complete the dialog box.
 - Name the action "Market Button".
 - Under **Source Sheets**, select **Markets**.
 - Under **Run action on**, select **Hover**.
 - Under **Target Sheets**, select **Bump Chart** and **Highlight Table**.

- Under **Target Highlighting**, select **Selected Fields**, and then click the check box next to **Market**.
 - Click **OK**.
10. Click **OK**.
 11. Test the action on the dashboard.

SELF CHECK 1 ANSWER The EMEA market was ranked 1 a total of nine months.

SELF CHECK 2 ANSWER A tie between LATAM and USCA, as neither market was ranked 1.

SELF CHECK ANSWER 3 The APAC market seems to have experienced the most variance in rank; it was ranked 1 three times, and 4 twice.

NOTE For an example of a complete solution to this practice, see **Bump_Chart_Solution.twbx**.

Solution: Slope Chart

The following is a solution to "Practice: Creating a Slope Chart" on page 43.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.

Directions: Create the initial view

1. From Tableau Desktop, connect to the Excel data source **NYCBabyNames.xlsx** (in the **Practices\Data** folder).
2. On **Sheet 1**, from the **Data** pane, drag **Birth Year** to **Columns**.
3. On the **Birth Year** on **Columns**, click the drop-down arrow, and select **Discrete**.
4. CTRL+drag a copy of **Birth Year** from **Columns** to **Filters** and in the **Filter** dialog box, on the **General** tab, select **2011** and **2013**, and click **OK**.
5. From the **Data** pane, drag **Count** to **Rows**.
6. On the **Marks** card, select the mark type **Line** on the drop-down.
7. In the view, hover on the right edge of the chart until you see a double-arrow, then drag to widen the columns in the view.

Add Name information

1. From the **Data** pane, drag **Name** to **Label** on the **Marks** card.
2. On **Rows**, do the following:
 - Click the drop-down menu on **SUM (Count)**, point to **Quick Table Calculation** and then click **Rank**.
 - Click the drop-down menu on **SUM (Count)** △, click **Compute Using** and choose **Name**.
3. CTRL+drag a copy of **SUM (Count)** △ from **Rows** to **Filters**, and in the **Filter** dialog box, enter a range from 1 to 10, and then click **OK**.
4. Right-click the **Rank of Count** axis, and click **Edit Axis**.
5. In the **Edit Axis** dialog box:
 - Under **Scale**, select **Reversed**.
 - Click **X** to close the dialog box.

- On the **Marks** card, click **Label**, and select **Line Ends**.
Click anywhere outside the dialog box to close it.

Add Rank numbers and color to the view

- CTRL+drag a copy of **SUM (Count)** Δ from **Rows** to **Label** on the **Marks** card.
- On the **Marks** card, click **Label**, and under **Label Appearance**, edit the label to read: **<Rank of SUM (Count)>. <Name>**
- CTRL+drag a copy of **SUM (Count)** Δ from **Rows** to **Color**.
- On **Color**, under **Markers**, choose the **All** icon, and then click **Edit Colors**.
 - In the **Edit Colors** dialog box:
 - Choose the **Orange-Blue Diverging** palette.
 - Select **Stepped Color** using 5 steps.
 - Click **OK**.

Add final formatting

- Right click the **Rank of Count** axis, and clear the check for **Show Header**.
- Right-click the view, click **Format**, click the **Rows** tab, and click the **Lines** icon.
- In the **Grid Lines** drop-down, select **None** to hide the row grid lines.
- On the **Marks** card, click **Label**.
- Click the **Alignment** drop-down, set **Horizontal** to **Left**, and set **Vertical** to **Top**.

SELF CHECK 1 ANSWER Sophia and David had the largest increase in popularity by rank, up 3 spaces from 2011.

SELF CHECK 2 ANSWER Matthew had the largest decrease in popularity by rank, down 6 spaces from 4 to 10.

Bonus: Use Calculated Fields and Filters in a Slope Chart

- On the **Sheet 1** worksheet tab, right-click and choose **Duplicate**.
- On the new worksheet, double-click to activate editing and type "Sheet 2".
- Click the arrow at the top of the **Data** pane, and select **Create Calculated Field**.
- In the **Calculated Field** dialog box, name the calculation "Rank".
 - Enter the following formula in the calculation editor:


```
RANK(SUM([Count]))
```
 - Click **OK**.
- Repeat step 3, and in the **Calculated Field** dialog box, name the calculation "Window Min".
 - Enter the following formula in the calculation editor:


```
WINDOW_MIN([Rank])
```
 - Click **OK**.
- Drag the newly created **Window Min** to **Filters** on top of the **SUM (Count)** Δ field to replace it.
- In the **Filter** dialog box, choose a **Range of Values** from 1 to 10, and then click **OK**.
- In **Window Min** Δ , click the drop-down menu and select **Edit Table Calculation**.

9. Use the steps below to complete the **Table Calculation** dialog box:
 - In the **Nested Calculations** section, click **Rank**.
 - In the **Compute Using** section, click **Specific Dimensions**. Click the **Name** check box and clear the **Birth Year** check box.
 - Click **X** to close the dialog box.
10. On the **Filters** shelf, click **Window Min** Δ , click the drop-down menu and select **Edit Filter**.
11. In the **Filter** dialog box, reset the **Range of values** to 1 through 10, and click **OK**.
(The values were reset when you edited the table calculation.)

BONUS SELF CHECK 1 The popularity by rank of Noah in 2011 was 24. The popularity by rank of Justin in 2013 was 30.

BONUS SELF CHECK 2 The single calculation `WINDOW_MIN(RANK(SUM([Count])))` won't work instead of the calculations in steps 2 and 3 because separate calculations are required to determine, respectively, the top ten names by rank in 2011 and 2013, and the popularity by rank of any name in the top ten in 2011 and 2013, regardless of where it ranked in 2011 or 2013.

NOTE For an example of a complete solution to this practice, see **Slope Chart Solution.twbx**.

Solution: Annual Purchase Frequency by Customer Cohort

The following is a solution to "Practice: Annual Purchase Frequency by Customer Cohort" on page 48.

Build the initial view:

1. Connect to **Global Superstore.xlsx**.
2. On the **Data Source** tab, in the left pane under **Sheets**, double-click **Orders** (or drag and drop it onto the **Drag tables here** area).
3. Drag **Customer ID** to **Rows**. If prompted, choose **Add All Members**.
4. Right-click **Customer ID**, click **Measure**, and then select **Count Distinct**.
5. Click the arrow at the top of the **Data** pane, and select **Create Calculated Field**. Name the field "Cohort" and enter the following in the text box:


```
{FIXED [Customer ID]: MIN (YEAR([Order Date]))}
```
6. Right-click **Cohort** and choose **Convert to Dimension**.
7. From the **Data** pane, drag **Cohort** to **Color** on the **Marks** card.
8. Click the arrow at the top of the **Data** pane, and select **Create Calculated Field**. Name the field "Number of purchases per customer per year", and enter the following in the text box:


```
{FIXED [Customer ID], YEAR([Order Date]): COUNTD([Order ID])}
```
9. Right-click **Number of purchases per customer per year** and choose **Convert to Dimension**.
10. Bring **Number of purchases per customer per year** to **Columns**.
11. Set the mark type to **Line**.
12. Right-click and drag **Order Date** to **Filters**, select **Years**, click **Next**, select all years, and then click **OK**.
13. On **YEAR(Order Date)** in **Filters**, click the drop-down menu, click **Show Filter**, then configure the filter as **Single Value (dropdown)**, and select **2019** on the filter.

Change line chart from totals to a running sum

- On **Rows**, do the following:
 - Right-click **CNTD(Customer ID)**, click **Quick Table Calculation**, and then click **Running Total**.
 - Right-click **CNTD(Customer ID)** again, click **Edit Table Calculation** and enter the following values:
 - Under **Compute Using**, click **Specific Dimensions**.
 - Ensure the **Number of purchases** check box is checked.
 - Ensure **Cohort** is not checked.
 - Under **Sort Order**, click the drop-down arrow next to **Specific Dimensions** and select **Custom**.
 - Sort by **Number of purchases per customer per year** and **Average**, and then select **Descending**.
 - Click the **X** to close the dialog box.

Determine the percentage of customers per cohort making purchases in a year

- CTRL+drag **CNTD(Customer ID)** from **Rows** to the **Data** pane and rename the resulting calculation "Running Total".
- Click **Analysis** and then select **Create Calculated Field**. Name the field "% of Total Customers per Cohort" and enter the following:

$$[\text{Running Total}] / \text{SUM}(\{\text{FIXED}[\text{Cohort}]: \text{COUNTD}([\text{Customer ID}])\})$$
- Replace the measure on **Rows** by dragging % of Total Customers per Cohort to **Rows**, on top of it.
- Format the % of Total Customers per Cohort axis. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> Right-click the % of Total Customers per Cohort axis and click Format. In the Format pane, under Scale and then Numbers, click the drop-down arrow and select Percentage with zero decimal places. Click the X to close the Format pane. Click on the null indicator and then click Filter data to exclude the nulls from the view. 	<ul style="list-style-type: none"> On Rows, right-click % of Total Customers per Cohort△, and click Format Number. Under Number Type, select Percentage. Under Decimal Places, use the down arrow to select 0. Click outside the dialog box to close it.

Format tooltip

- From the **Data** pane, drag **Order Date** to **Rows**, to the left of % of Total Customers per Cohort. Right-click **YEAR (Order Date)** and deselect **Show Header** to hide the header.
- Update the tooltip as follows: "In <YEAR(Order Date)>, <AGG(% of Total Customers per Cohort)> of customers from the <Cohort> cohort purchased at least <Number of purchases per customer per year> time(s)."
- On the toolbar, change the view to **Entire View**.

4. Right-click the **Sheet 1** title, and click **Edit Title**.
5. Rename the title to read "Annual Cohort Purchase Frequency" and then click **OK**.

SELF CHECK 1 ANSWER In 2019, what percentage of customers in the 2016 cohort purchased at least two times? 56%

SELF CHECK 2 ANSWER Which yearly cohort exhibits the most customer loyalty? The 2016 cohort.

NOTE For an example of a complete solution to this practice, see **Annual Cohort Purchase Frequency Solution.twbx**.

Solution: Student Survey

The following is a solution to "Practice: Student Survey" on page 50.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.

Directions: Shape the data

1. Connect to **Student Satisfaction.xlsx**.
2. Click **Data Source** in the lower left corner.
3. In the **Data** grid, select the columns for **Q1** through **Q5**, right click and then select **Pivot**.
Alternatively, you can select the rows for **Q1** through **Q5** in the **Metadata** grid.
4. Right-click **Pivot Field Names**, click **Rename**, and then type "Question".
5. Right-click **Pivot Field Values**, click **Rename**, and then type "Response".
6. Go to **Sheet 1**.

Create a blend using the Helper file to edit primary aliases

1. Click **Data** and select **New Data Source**.
2. In the **Connect** dialog box, under **To a File**, click **Excel**.
3. In the **Open** dialog box click **Helper file.xlsx**, and click **Open**.
4. Click the **New Worksheet** button to go to **Sheet 2**.
5. Using the **Survey Data** data source, drag **Question** to **Rows**.
6. Using the **Helper File** data source, drag **Description** to **Rows** to the right of **Question**.
7. On **Rows**, right-click **Description**, select **Edit Primary Aliases**, and then click **OK**. **Question** from **Survey Data** should now be populated with the **Description** from **Helper file**.
8. Go back to **Sheet 1**.
9. Double-click the **Sheet 1** tab to activate editing, and name the worksheet "Survey Responses".

NOTE The blend is temporary and used only to edit primary aliases. You do not need the blend after you complete this task.

Create the view

1. Using **Survey Data**, drag **Survey Data (Count)** to **Columns**.
2. Right-click **CNT(Survey Data)**, and then click **Add Table Calculation**.
 - In the **Table Calculation** dialog box, under **Calculation Type**, select **Percent of Total**.
 - Under **Compute Using**, select **Cell** and then click the **X** in the upper right corner of the dialog box to close it.
3. CTRL+drag **CNT(Survey Data)**△ from **Columns** to **Label** on the **Marks** card, and then right-click it and select **Format**.
 - In the **Format** pane, under **Default**, click the **Numbers** drop-down.
 - In the dialog box, select **Percentage**, and change it to zero decimal points.
 - Click anywhere to close the dialog box
 - Click **X** in the upper right corner to close the **Format** pane.
4. From the **Data** pane, drag **Major** and **Question** to **Rows**.
5. On **Rows**, right-click **Major**, and select **Sort**. Then, in the **Sort [Major]** dialog box:
 - Under **Sort By**, select **Manual**.
 - Click **Non-STEM Major** and then the down arrow.
 - Click the **X** to close the dialog box.
6. In the **Data** pane:
 - Right-click **Response**, click **Duplicate**, and rename the duplicate "Response (Dimension)."
 - Right-click **Response (Dimension)** and select **Convert to Dimension**.
 - Drag **Response (Dimension)** to **Color** on the **Marks** card.
7. Edit the colors using the **Tableau 20** color palette so that the numbers 1-5 appear as follows:
 - 1 = dark orange
 - 2 = light orange
 - 3 = gray
 - 4 = light blue
 - 5 = dark blue
8. Edit the color legend title to read "Response".
9. Right-click **Response (Dimension)** on the **Marks** card, click **Edit Aliases**, and then under **Value (Alias)**:
 - Rename 1 to "1 - Strongly Disagree"
 - Rename 3 to "3 - Neutral"
 - Rename 5 to "5 - Strongly Agree"
 - Click **OK**.
10. Create an LOD calculation called "Average Response" as follows:


```
{FIXED[Major], [Question]: AVG([Response])}
```
11. Drag **Average Response** to **Rows** to the right of **Question**.
12. Right-click **SUM(Average Response)**, and click **Discrete**.
13. Right-click **SUM(Average Response)** again, and click **Format**.
 - In the **Format** pane, under **Default**, click the **Numbers** drop-down.
 - In the dialog box, select **Numbers (Custom)** and change it to 1 decimal place.
 - Click anywhere to close the dialog box.
 - Click **X** in the upper right corner to close the **Format** pane.

14. Right-click the axis, select **Edit Axis**, and under **Title**, edit the title to read "% of Total Responses" and then click **X** to close the dialog box.
15. Click **Tooltip** on the **Marks** card. In the **Edit Tooltip** dialog box:
 - Delete the following entries:
 - The table calc % of Total CNT(Survey Data).
 - The LOD expression **Average Response**.
 - Change the text before <Response (Dimension)> to "Response".
 - Click **X** to close the **Edit Tooltip** dialog box.
16. Click the **Fit** drop-down menu and select **Entire View**.

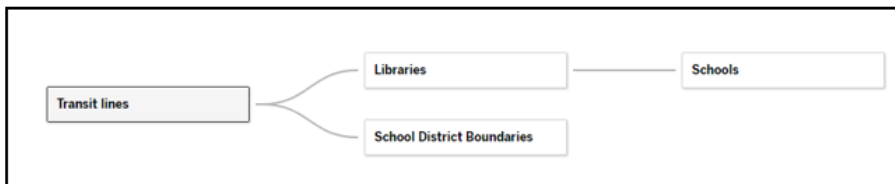
NOTE For an example of a complete solution to this practice, see **Student Survey Solution.twbx**.

Solution: Using Marks Layers for Maps

The following is a solution to "Practice: Using Marks Layers for Maps" on page 54.

Create the initial map with School Districts and Libraries

1. Use **Using_Marks_Layers_for_Maps_Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
2. On the **Data Source** tab, view the relationships.



3. Click **Sheet1**, and rename it "Greater Portland (OR) Resource Map".
4. From the **School District Boundaries** table in the **Data** pane, drag **Shape (School District Boundaries)** to the canvas.
5. Drag **Distname** to **Color** on the **Marks** card. If prompted, click **Add All Members**.
6. From the **Libraries** table in the **Data** pane, drag **Shape (Libraries)** to the canvas and drop it on the **Add a Marks Layer** icon that appears in the upper left of the canvas.

SELF CHECK 1 How many libraries are in Banks? Answer: 1.

7. On the **Marks** card, click **Libraries.Shape** to open that layer of the **Marks** card, and from the **Libraries** table in the **Data** pane, drag **Name** to **Detail**.
8. On the **Marks** card for **Libraries.Shape**, click the drop-down and make sure that **Disable Selection** does not have a check mark next to it.
9. On the **Marks** card for **School District Boundaries.Shape**, click the drop-down and select **Disable Selection**.
10. On the **Marks** card, make the following changes to the **Libraries.Shape** layer:
 - Change the color to white with a dark gray border.
 - Change the mark type to circle.
 - Increase the size of the circle slightly.

Add Marks Layers for Schools and Transit Lines

- From the **Schools** table in the **Data** pane:
 - Drag **Shape (Schools)** to the canvas and drop it on the **Add a Marks Layer** icon that appears in the upper left of the canvas.
 - Drag **Name** to **Detail** on the **Schools.Shape** layer on the **Marks** card.
- On **Schools.Shape** on the **Marks** card, make the following changes:
 - Change the color to red with a black border.
 - Change the mark type to square.
 - Decrease the size slightly.
- From the **Transit lines** table in the **Data** pane, drag **Shape** to the canvas and drop it on the **Add a Marks Layer** icon that appears in the upper right of the canvas.
- On the **Marks** card, click the drop-down for **Transit lines** and select **Disable Selection**.
- On the **Marks** card for **Transit lines**:
 - Slightly decrease the size.
 - Click the drop-down and select **Move down**.
 Alternatively, drag **Transit lines** below **Libraries.Shape** on the **Marks** card.

SELF CHECK 1 Answers may vary. Trends include that there are more schools and libraries in districts with transit lines. Additional questions could include district population, urban/suburban/rural designation, median income, and so on.

NOTE For an example of a complete solution to this practice, see **Using_Marks_Layers_for_Maps_Solution.twbx**.

Solution: Creating a Hexbin Map

The following is a solution to "Practice: Creating a Hexbin Map" on page 56.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.

Directions: Create the initial view

- Open **Hexbin Map Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
- From the **Data** pane, drag **Pickup TimeRanges** to **Filters**, select **Really early morning**, and then click **OK**.
- Right-click **Pickup TimeRanges** in **Filters** and click **Show Filter**.
- On the **Pickup TimeRanges** filter in the view, click the drop-down menu and select **Single Value List**.
- On the **Marks** card, change the mark type to **Shape**.
- Click the arrow at the top of the **Data** pane, and then click **Create Parameter**.
- In the **Create Parameter** dialog box, name the parameter "Scale Factor", and use the following settings:
 - Data type:** Integer
 - Current value:** 500

- **Value when workbook opens:** Current value
- **Display format:** Automatic
- **Allowable values:** Range
- **Minimum:** 50
- **Maximum:** 1000
- **Step size:** 10

TIP: The scale factor parameter will be used to help adjust the view for formatting, and will be removed from the final view.

8. Click **OK**.
9. In the **Data** pane, under **Parameters**, right-click **Scale Factor**, and click **Show Parameter**.

Create hexbin fields that include the scale factor

1. Click the arrow at the top of the **Data** pane, and click **Create Calculated Field**.
2. In the Calculated Field editor, name the field "HexbinX", and write the field as follows:
`HEXBINX([Pickuplon] * [Scale Factor], [Pickuplat] * [Scale Factor]) / [Scale Factor]`
3. Create another calculated field called "HexbinY" written as follows:
`HEXBINY([Pickuplon] * [Scale Factor], [Pickuplat] * [Scale Factor]) / [Scale Factor]`
4. Right-click **HexbinX** and choose **Convert to Dimension**.
5. Right-click **HexbinY** and choose **Convert to Dimension**.
6. Right-click **HexbinX**, point to **Geographic Role**, and select **Longitude**.
7. Right-click **HexbinY**, point to **Geographic Role**, and select **Latitude**.

Create a hexbin map and adjust the size of the hexbins

1. From the **Data** pane:
 - Drag **HexbinX** to **Columns**, and drop on top of **Pickuplon**, replacing it.
 - Drag **HexbinY** to **Rows**, and drop on top of **Pickuplat**, replacing it.
 - Drag **Number of Records** to **Color**.
2. On the **Marks** card, click **Color**, then **Edit Colors**, and choose a blue color palette with 5 steps.
3. Create a new folder in the **Shapes** directory (Windows: My Documents (Mac: Documents)\My Tableau Repository\Shapes) called "Hex".
4. Copy **hex_solid.png** from the **Data** folder in the **Practices** folder into the new **Hex** folder.
5. On the **Marks** card, click on **Shape**, and then click **More Shapes**.
6. Click **Reload Shapes**, click **Apply**, click the drop-down and navigate to the **Hex** folder, click the solid hexagon, click **Apply**, and then click **OK**.

Adjust the formatting

1. Adjust the map zoom so that Manhattan is the visual focus of the view.
2. Adjust both the size of the hexagons using **Size** on the **Marks** card and the scale factor using the parameter control until the resolution of the view is informative and the hexagons tessellate, or fit together, properly.
3. Click the drop-down arrow on the parameter control and choose **Hide Card**.

4. On the color legend in the view, click the drop-down arrow and select **Edit Colors**.
5. On the **Edit Colors** dialog box, click **Advanced** and adjust the range of the scale as follows:
 - **Start:** 1
 - **End:** 500
6. Click **OK**.
7. On the menu, click **Map**, and then click **Background Layers**.
8. In the **Background Layers** pane, do the following and then click the **X** to close the pane:
 - Under **Background**, in the **Style** field, change the background from **Light** to **Streets**.
 - Under **Background Map Layers**, select the following check boxes:
 - **Base**
 - **Terrain**
 - **Streets, Highways, Routes**
 - **Cities**
 - **Neighborhoods**
 - **Subway and Train Stations**
9. Click **Color** on the **Marks** card and adjust the opacity of the marks to about 80%.

SELF CHECK ANSWER 4-Mid-day seems to have the most pickups of any time period.

NOTE For an example of a complete solution to this practice, see **Hexbin Map Solution.twbx**.

Solution: Advanced Spatial Files

The following is a solution to "Practice: Advanced Spatial Files" on page 58.

NOTE Tableau Desktop is required to complete this practice. If you desire to share this view on your site on Tableau Server/Cloud, create the view in Tableau Desktop and then publish it to your site.

Connect to the Iowa Counties Spatial File

1. Open **Advanced Spatial Files Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
2. Click the **Data Source** tab.
3. Under **Connections**, click **Add**, and under **To a file**, click **Spatial file**.
4. Browse to the **Data** folder in the **Practices** folder, click the **IA_County_Boundaries.shp** file, and then click **Open**.
5. On the canvas, double-click **2015 Median Income Iowa.csv** on the logical layer, then drag **IA_County_Boundaries.shp** from under **Files** to the right of **2015 Median Income Iowa.csv** to open the **Join** dialog box.
6. In the **Join** dialog box, complete the following steps:
 - Under **Data Source**, from the drop-down list, select the **County FIPS** field. Keep the join type as **Inner Join**.
 - Under **IA_County_Boundaries.shp**, from the drop-down list, select the **Co Fipscode** field.
 - Click the **X** to close the dialog box.
 - Do not close the physical layer (that is open on the canvas).

Connect to the Iowa Census Tracts Spatial File

1. On the **Data Source** tab, under **Connections**, click **Add**, and under **To a file**, click **Spatial file**.
2. Browse to the **Data** folder in the **Practices** folder, click the **IA_census_2015_19_tract_500k.shp** file, and then click **Open**.

The file, and an open **Join** dialog box, will appear on the open physical layer.

3. In the open **Join** dialog box, complete the following steps:
 - Under **Data Source**, under **2015 Median Income Iowa.csv** on the drop-down list, select **Tract GeoID**. Keep the join type as **Inner Join**.
 - Under **IA_census_2015_19_tract_500k.shp**, from the drop-down list, select **Geoid**.
 - Click the **X** to close the dialog box.
 - Do not close the physical layer.

Connect to the Iowa Interstates Spatial File

1. On the **Data Source** tab, under **Connections**, click **Add**, and under **To a file**, click **Spatial file**.
2. Browse to the **Data** folder in the **Practices** folder, click the **IA_Interstate_Highway_System.shp** file, and then click **Open**.

The file and an open **Join** dialog box will appear on the physical layer.

3. In the **Join** dialog box, complete the following steps:
 - Under **Data Source**, under **2015 Median Income Iowa.csv** on the drop-down list, select **Road Status**. Keep the join type as **Inner Join**.

- Under **IA_Intersate_Highway_System.shp**, from the drop-down list, select **Road Statu**.
- Click the **X** to close the dialog box.

Create a map parameter and calculated field

1. Click **Sheet 1**.
2. Click the drop-down arrow at the top of the **Data** pane, and select **Create Parameter**.
3. In the **Create Parameter** dialog box, complete the following steps:
 - Under **Name**, type "Map Choice".
 - Set the **Data Type** drop-down list to **String**.
 - Set **Value when workbook opens** to "Current value".
 - Under **Allowable values**, select **List**.
 - In **List of values**, enter the values shown in the following table, and then click **OK**.

Value	Display as
County	County
Census Tract	Census Tract

4. Click the drop-down arrow at the top of the **Data** pane, and select **Create Calculated Field**.
5. In the **Calculated Field** dialog box, complete the following steps:
 - Enter "Map Hierarchy" as the name.
 - In the **Formula** field, enter the following text, and then click **OK**.


```
IF ([Map Choice] == "County") THEN [Geometry]
ELSE [Geometry (IA census 2015 19 tract 500k.shp)]
END
```

Create an LOD calculated field to calculate average income based on map choice

1. Click the drop-down arrow at the top of the **Data** pane, and select **Create Calculated Field**.
2. In the **Calculated Field** dialog box, complete the following steps:
 - Enter "Median Income (Calculated)" as the name.
 - In the **Formula** field, enter the following text, and then click **OK**.


```
IF ([Map Choice] == "County") THEN
{FIXED [County]: AVG([Median income (est.)])}
ELSE
[Median income (est.)]
END
```
3. In the **Data** pane, edit the default properties for the **Median Income (Calculated)** field:
 - Right-click the field, point to **Default Properties**, point to **Aggregation**, and then click **Average**.
 - Right-click the field again, point to **Default Properties**, and then click **Number Format**.
 - In the **Default Number Format** dialog box, select **Currency (Custom)**, enter **0** for the number of decimal places, and then click **OK**.

Create a parameter-controlled map

1. From the **Data** pane, drag the **Map Hierarchy** field onto the canvas.
2. From the **Data** pane, under **State Name**, **County**, drag **County** to **Detail** on the **Marks** card.

3. From the **2015 Median Income Iowa.csv** table in the **Data** pane:
 - Right-click **Tract Name** and select **Convert to Dimension**.
 - Drag **Tract Name** to **Detail** on the **Marks** card.
4. Under **Parameters**, right-click **Map Choice**, and then click **Show Parameter**.
5. From the **Data** pane, drag **Median Income (Calculated)** to **Color** on the **Marks** card.
6. On the **Marks** card, click **Color**, and then click **Edit Colors**.
7. In the **Edit Color** dialog box, select the **Stepped Color** check box, set the number of steps to **4**, and then click **OK**.

Create a dual-axis spatial map

1. On the **Columns** shelf, CTRL+click the **Longitude (generated)** and drag to place a copy of it to the right of the first **Longitude** field on **Columns**.
2. On the **Marks** card, click the second **Longitude** tab, and remove all fields on that tab.
3. From the **IA Interstate Highway System.shp** table in the **Data** pane, drag the **Geometry (IA Interstate Highway System.shp)** field onto the blank, second **Longitude** tab on the **Marks** card, and place on **Detail**.
4. On the second **Longitude** tab, click **Color**, and then select dark orange.
5. On the **Columns** shelf, right-click the **Longitude (generated)** field on the right, and then click **Dual Axis**.
6. Use the **Map Choice** parameter control to change the detail from the county level to the census tract level and observe the results.

SELF CHECK 1 ANSWER Dallas County had the highest median income at \$76,693. Within Dallas County, Census Tract 508.05 had the highest median income in the county at \$136,500.

SELF CHECK 2 ANSWER Though not conclusive, counties and census tracts with higher median incomes appear to be located near interstate highways.

NOTE For an example of a complete solution to this practice, see **Advanced Spatial Files Solution.twbx**.

Solution: Dynamic Zone Visibility in Dashboards

The following is a solution to "Bonus Practice: Sheet Swapping and Containers" on page 117.

Directions: Create Parameter and calculated fields

1. Open **Dynamic Zone_Starter.twbx** (found in the **Practices\Workbooks\Starters** folder), which contains worksheets for **Scatter Plot**, **Global Map**, and **Bar Chart**. Note the corresponding color shading for each view and its legend(s).
2. At the top of the **Data** pane on the **Scatter Plot** worksheet, click the drop-down arrow and select **Create Parameter**. The **Create Parameter** dialog box opens.
3. In the **Create Parameter** dialog box, name the parameter "Select Sheet" and configure as follows:
 - **Data type:** String
 - **Allowable values:** List
 - **Value and Display As:** "Scatter Plot"

- **Value and Display As:** "Global Map"
 - **Value and Display As:** "Bar Chart"
4. Click **OK**.
 5. In the **Data** pane, right-click the **Select Sheet** parameter, and click **Show Parameter**.
 6. At the top of the **Data** pane, click the drop-down arrow and select **Create Calculated Field**. The **Calculation Editor** opens.
 7. In the **Calculation Editor**, name the calculated field "Scatter" and configure the calculation as follows: `[Select sheet] = "Scatter Plot"`
 8. Click **OK**.
 9. Create two additional Boolean calculated fields titled "Map" and "Bar" to return True when the user selects Global Map or Bar Chart in the parameter, using the following syntax:

```
[Select sheet] = "Global Map"
```

```
[Select sheet] = "Bar Chart"
```

Create the Dashboard

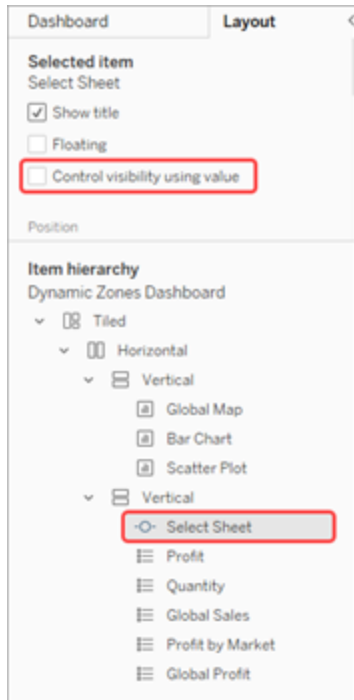
1. Click the **New Dashboard** button.
2. Under **Objects**, drag a vertical tiled container to the view.
3. From **Sheets**, drag **Scatter Plot** into the container.
4. Drag **Global Map** into the container. Make sure the container is highlighted blue before dropping the worksheet.
5. Drag **Bar Chart** into the container. Make sure the container is highlighted blue before dropping the worksheet.
6. On the dashboard, select the **Scatter Plot** view.
7. Click the drop-down arrow on the view, point to **Legends**, and ensure that both the associated **Profit** color legend and **Quantity** size legend are selected.
8. Repeat this process for the **Global Map** and **Bar Chart** views so that all legends display on the dashboard.
9. Drag the parameter control to reposition it above the legends.

Apply Dynamic Zone Visibility

1. Click the **Layout** tab on the **Dashboard** pane. Keep the **Layout** pane open for the remainder of this section.
2. Select **Scatter Plot** on the parameter control.
3. On the dashboard, select the **Scatter Plot** view. In the **Layout** pane:
 - Under **Selected Item**, select **Control visibility using value**.
 - From the drop-down menu, select **Scatter**. This associates the displayed view with the Boolean calculation.
4. On the dashboard, select the **Profit** color legend associated with the scatter plot. In the **Layout** pane:
 - Under **Selected Item**, select **Control visibility using value**.
 - From the drop-down menu, select **Scatter**. This associates the displayed legend with the Boolean calculation.

- Repeat these steps for the **Quantity** size legend.

TIP If you accidentally associate the parameter control with a dynamic zone, the parameter control may no longer be visible on the dashboard. To correct this, use the **Item hierarchy** section of the **Layout** pane to select the parameter and then, under **Selected item**, clear the **Control visibility using value** selection. Once a dashboard object is selected in the **Item hierarchy**, you can review or modify its settings, even when that object does not display on the canvas.



- Select **Global Map** on the parameter control.
- On the dashboard, select the **Global Map** view. In the **Layout** pane:
 - Under **Selected Item**, select **Control visibility using value**.
 - From the drop-down menu, select **Map**.
 - Use this process to apply zone visibility for the **Global Profit** and **Global Sales** legends associated with the map view.
- Select **Bar Chart** on the parameter control.
- On the dashboard, select the **Bar Chart** view. In the **Layout** pane:
 - Under **Selected Item**, select **Control visibility using value**.
 - From the drop-down menu, select **Bar**.
 - Use this process to apply zone visibility for the **Profit by Market** legend associated with the bar chart.
- Test the parameter control.

NOTE For an example of a complete solution to this practice, see **Dynamic Zone_Solution.twbx**.

Solution: Context Filters and Dashboards

The following is a solution to "Practice: Context Filters and Dashboards" on page 64.

Create the initial view

1. Open **Context Filters and Dashboard Starter.twbx** (found in the **Practices\Workbooks\Starters** folder).
2. Click **New Dashboard**, right-click the tab, click **Rename**, and type "Worldwide Sales".
3. Drag **Top 25 Cities for Sales** to the view.
4. Drag **Top 10 Product Sales** to the view, placing it below **Top 25 Cities for Sales**.
5. Click **New Worksheet**, and rename the sheet "Market".
6. Drag **Market** to **Columns**.
7. Drag **Sales** to **Text** on the **Marks** card.
8. Click the window fit drop-down on the toolbar and change from **Standard** to **Entire View**.
9. Format the view. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> ▪ On the Marks card, right-click SUM(Sales) and click Format. ▪ On the Format pane, under Default, click the drop-down arrow next to Alignment, and under Horizontal, click the Center icon. ▪ On the Format pane, under Default, click the drop-down arrow next to Numbers and select Currency (Custom) with 0 decimal places. ▪ Click the X in the upper-right corner of the Format pane to close it. ▪ Right-click the Market label in the view (not the title) and click Hide Field Labels for Columns. 	<ul style="list-style-type: none"> ▪ On the Marks card, right-click SUM(Sales) and click Format Number. ▪ Under Number Type, select Currency, and under Decimal Places, use the downward arrow to select 0. ▪ Click outside the dialog box to close it. ▪ On the Format menu, select Worksheet. ▪ In the Format pane, under Borders and Dividers, under Row Dividers, use the drop-down arrow to select None. ▪ If desired, in the Format pane, under Fonts, increase the font size. Then use the Worksheet menu to hide the sheet title.

10. On the **Worldwide Sales** dashboard, drag **Market** to the top of the dashboard.
11. Resize the **Market** sheet on the dashboard so that it is about half its original height.

Set up initial top N filters

1. On the **Top 10 Product Sales** sheet, drag **Product Name** to **Filters**.
 - Click the **Top** tab in Tableau Desktop or the **Top/Bottom** arrow in the browser, click **By field**, set values for **Top 10**, **Sales**, **Sum**, and then click **OK**.

2. On the **Top 25 Cities for Sales** sheet, drag the **City and State** field to **Filters**.
 - Click the **Top** tab in Tableau Desktop or the **Top/Bottom** arrow in the browser, click **By field**, set up values for **Top 25, Sales, Sum**, and then click **OK**.
3. On **Worldwide Sales**, click the **Market** sheet in the view so that it is highlighted and then click the **Use as Filter** icon.
4. Test the filter by clicking various markets to observe the filtered results on the dashboard. Notice that the view filters to **Market**, but it doesn't necessarily show top 25 cities for that market or top 10 products.
5. On the **Top 10 Product Sales** sheet, on **Filters**, right-click **Action (Market)** and click **Add to Context**.
6. On the **Top 25 Cities for Sales** sheet, on **Filters**, right-click **Action (Market)** and click **Add to Context**.
7. Go back to **Worldwide Sales** and click on various markets. Notice that clicking on **Market** now shows Top 25 and Top 10 in the results below.

Create filter action so map will filter Product Sales view

1. On **Worldwide Sales**, ensure that no markets are selected on the dashboard.
2. On the menu bar, click **Dashboard**, click **Actions**, click **Add Action**, and then click **Filter**.
3. Name the filter "Filter Map to Top 10 Products"
 - Under **Source Sheets**, ensure that **Top 25 Cities for Sales** is checked and the rest are unchecked.
 - Under **Target Sheets**, ensure that **Top 10 Product Sales** is checked and the rest are unchecked.
 - Under **Run action on**, click **Select**.
 - Under **Clearing the selection** will, click **Show all values**.
 - Click **OK**, and then click **OK** again.
4. Click on a city in the map to engage the filter action. Notice that, as before, the action filter needs to be added to context in order to return the top 10 products in the selected city.
5. On the **Top 10 Product Sales** worksheet, under **Filters**, right-click **Action (City, Country, State)** and click **Add to Context**.
6. Go back to **Worldwide Sales**, and notice that clicking a city on the map now updates the bar.

Add optional formatting

1. From the **Format** menu, select **Animations** to open the **Animations** pane.
2. In the **Animations** pane, under **Workbook Default**, click **On**, and then use the drop-down menus to experiment with duration and style.
3. Click the **Layout** tab, select a container on the dashboard, and experiment with borders, background color, and padding.
4. On the **Top 10 Product Sales** worksheet, on the **Worksheet** menu, select **Show Sort Controls** to turn the Sort Controls off.

In the **Worldwide Sales** dashboard you will be unable to change the sort order in **Top 10 Product Sales** because it is locked at the worksheet level.

NOTE For an example of a complete solution to this practice, see **Context Filters and Dashboard Solution.twbx**.

9. Appendix B: Bonus Practices (with Solutions)

This section contains bonus practices and solutions.

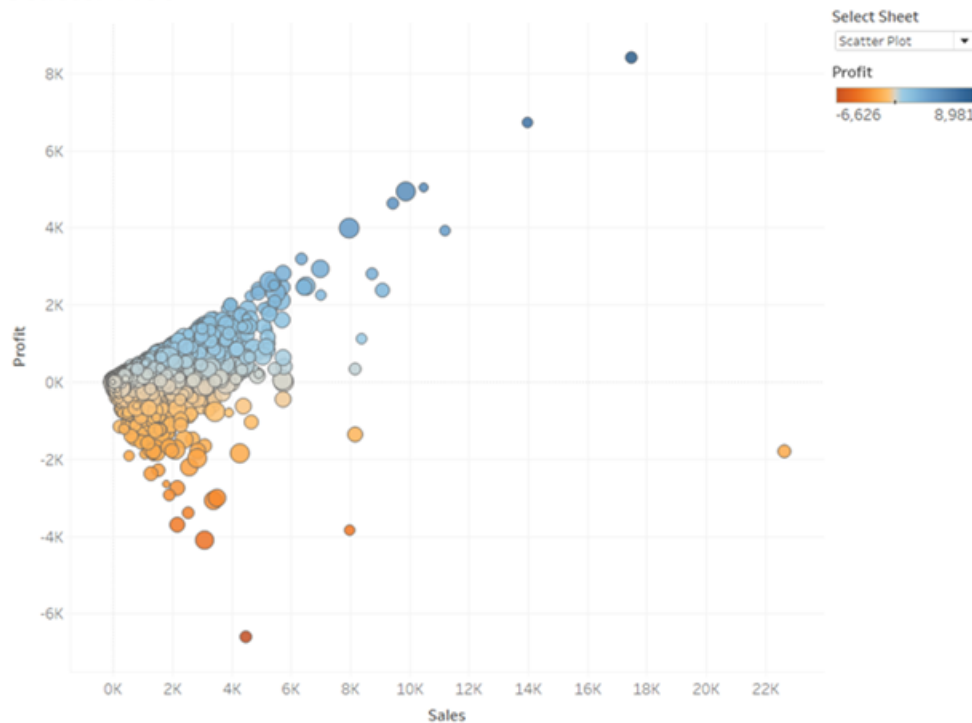


Bonus Practice: Sheet Swapping and Containers

You want to create a dashboard that allows users to swap among different sheets, with a profit legend for each sheet.

First, create a parameter and a calculated field to swap among sheets. Then, use containers and calculations to show the appropriate **Profit** color legend for each selected sheet.

Scatter Plot



Create Parameter and Calculated Fields

1. Open **Bonus-Sheet Swapping and Containers Starter.twbx** (found in the **Practices\Data** folder), which contains sheets for **Scatter Plot**, **Global Map**, and **Bar Chart**.

- On the **Scatter Plot** view, create a string parameter called "Select Sheet" with a list for the following: **Scatter Plot, Global Map, Bar Chart**.
- Create a calculated field called "Select Sheet Filter" that contains the **Select Sheet** parameter.

Create a Profit Color Legend to be Shared for All Worksheets

- Create a new sheet titled "Show Legend".
- On the **Show Legend** sheet, create a calculated field called "Color Legends for Sheets" that describes the visualization level of detail for each sheet as follows:

```
CASE [Select Sheet]
  WHEN "Scatter Plot" THEN [Customer ID] + [Market]
  WHEN "Global Map" THEN [Country] + [State] + [City]
  WHEN "Bar Chart" THEN [Market] + [Sub-Category]
END
```

- Drag **Color Legends for Sheets** to **Rows** and **Profit** to **Color**.

Set up Filters and Show the Parameter Control

- Add a filter for each worksheet and then show the parameter control. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
<ul style="list-style-type: none"> On the Scatter Plot sheet, create a filter using Select Sheet Filter. From the General tab, click the Custom value list button, type in "Scatter Plot", click the +, and then click OK On the Global Map sheet, repeat this process, this time using "Global Map" as the custom value. On the Bar Chart sheet, repeat this process again, this time using "Bar Chart" as the custom value. Show the parameter control, but leave it selected on Scatter Plot before continuing. 	<ul style="list-style-type: none"> On the Scatter Plot sheet, create a filter using Select Sheet Filter. Under General, use the List drop-down and select Custom value list. Type in "Scatter Plot", click Add, and then click OK. On the Global Map sheet, repeat this process, this time using "Global Map" as the custom value. On the Bar Chart sheet, repeat this process again, this time using "Bar Chart" as the custom value. Show the parameter control, but leave it selected on Scatter Plot before continuing.

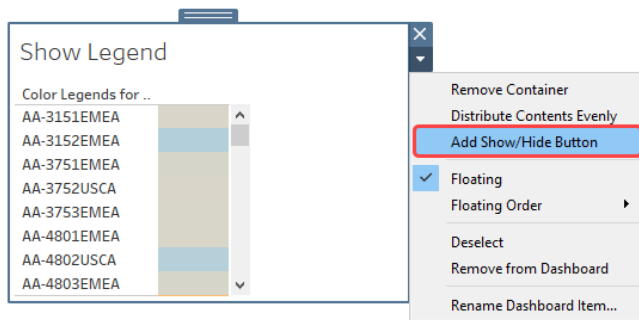
Create the Dashboard

- Open a new dashboard, and drag a vertical tiled container to the view.
- Drag **Scatter Plot** into the container.

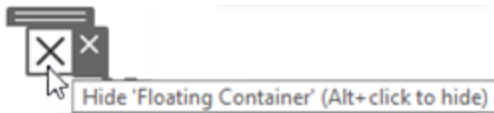
3. Drag **Global Map** so that it is directly above **Scatter Plot** in the container. (Make sure the container is highlighted dark blue before dropping into the container.) **Global Map** will appear as a narrow bar, displaying only its title; this is expected. **TIP** If you are completing this exercise from the browser, you may need to resize the container for the views to make it wider, and the container for the legends to make it narrower.
4. Drag **Bar Chart** into the container.
5. Hide the titles for each sheet.
6. Remove any legends in the view so that only the parameter remains.

Format the Dynamic Color Legend

1. With **Floating** selected, drag a horizontal container into the view.
2. Select **Rename Dashboard Item** on the context menu and type "Floating Container" in the **Rename Dashboard Item** dialog. Click **OK**.
3. Shift + drag **Show Legend** into the container. (Make sure the container is highlighted dark blue before dropping into the container.)
4. Click the **Show Legend** drop-down arrow and then click **Select Container: "Floating Container"**.
5. On the container context menu, select **Add Show/Hide Button**.



6. Alt + click the button to hide the container.



7. Remove the button from the dashboard.
8. Show the dashboard title, and edit it so that it uses the **Select Sheet** parameter as a title.

Solution

For the solution to this practice, see "Bonus Solution: Sheet Swapping and Containers" on page 120.

Bonus Solution: Sheet Swapping and Containers

The following is a solution to "Bonus Practice: Sheet Swapping and Containers" on page 117.

Create Parameter and Calculated Fields

1. Open **Bonus-Sheet Swapping and Containers Starter.twbx** (found in the **Practices\Data** folder), which contains sheets for **Scatter Plot**, **Global Map**, and **Bar Chart**.
2. At the top of the **Data** pane on the **Scatter Plot** worksheet, click the drop-down arrow and select **Create Parameter**. The **Create Parameter** dialog box opens.
3. In the **Create Parameter** dialog box, name the parameter "Select Sheet" and configure as follows:
 - **Data type:** String
 - **Value when workbook opens:** Current value
 - **Allowable values:** List
 - **Value and Display As:** "Scatter Plot"
 - **Value and Display As:** "Global Map"
 - **Value and Display As:** "Bar Chart"
4. Click **OK**.
5. At the top of the **Data** pane, click the drop-down arrow and select **Create Calculated Field**. The **Create Calculated Field** dialog box opens.
6. In the **Create Calculated Field** dialog box, name the calculated field "Select Sheet Filter" and enter the following value: `[Select sheet]`.
7. Click **OK**.

Create a Profit Color Legend to be Shared for All Worksheets

1. Click the **New Worksheet** button and name the sheet "Show Legend".
2. At the top of the **Data** pane, click the drop-down arrow and select **Create Calculated Field**. The **Create Calculated Field** dialog box opens.
3. In the **Create Calculated Field** dialog box, name the calculated field "Color Legends for Sheets" and configure the calculation as follows:


```
CASE[Select sheet]
  WHEN "Scatter Plot" THEN[Customer ID] + [Market]
  WHEN "Global Map" THEN[Country] + [State] + [City]
  WHEN "Bar Chart" THEN[Market] + [Sub-Category]
END
```
4. Drag **Color Legends for Sheets** to **Rows**. If prompted, click **Add all members**.
5. Drag **Profit** to **Color** on the **Marks** card.

Set up filters and show the parameter control

1. Add a filter for each worksheet and then show the parameter control. Follow the directions for your environment:

From Tableau Desktop:	Or From the Browser:
▪ On the Scatter Plot sheet, drag	▪ On the Scatter Plot sheet, drag

From Tableau Desktop:	Or From the Browser:
<p>Select Sheet Filter to Filters.</p> <ul style="list-style-type: none"> From the General tab, click the Custom value list button, type in "Scatter Plot", click the +, and then click OK. On the Global Map sheet, repeat this process, this time using "Global Map" as the custom value. On the Bar Chart sheet, repeat this process again, this time using "Bar Chart" as the custom value. Right-click the Select Sheet parameter, click Show Parameter Control, and make sure it is set to Scatter Plot before continuing. 	<p>Select Sheet Filter to Filters.</p> <ul style="list-style-type: none"> Under General, use the List drop-down and select Custom value list. Type in "Scatter Plot", click Add, and then click OK. On the Global Map sheet, repeat this process, this time using "Global Map" as the custom value. On the Bar Chart sheet, repeat this process again, this time using "Bar Chart" as the custom value. Right-click the Select Sheet parameter, click Show Parameter, and make sure it is set to Scatter Plot before continuing.

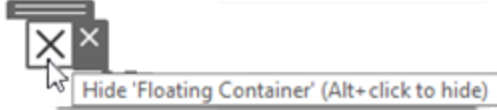
Create the Dashboard

- Click the **New Dashboard** button.
- Under **Objects**, click **Tiled**, and drag a vertical tiled container to the view.
- From **Sheets**, drag **Scatter Plot** into the container.
- Drag **Global Map** into the container so that it is placed in a narrow area directly above **Scatter Plot**. Make sure the container is highlighted blue before dropping it into the container. After it is dropped, you should see only the title. **TIP** If you are completing this exercise from the browser, you may need to resize the container for the views to make it wider, and the container for the legends to make it narrower.
- Drag **Bar Chart** into the container so that it is also placed in a narrow area directly above **Scatter Plot**. Make sure the container is highlighted blue before dropping it into the container. After it is dropped, you should see only the title.
- On each sheet in the container, right-click on the title and click **Hide Title**. You should now see only the Scatter Plot.
- Delete the **Profit**, **Quantity**, and **Sales** legends in the view, so that only the parameter control remains.

Format the Dynamic Color Legend

- Click **Floating**. Under **Objects**, click **Horizontal** and then drag a horizontal floating object into the view, placing it below the parameter control.
- Click the drop-down arrow on the container. Select **Rename Dashboard Item** on the context menu and type "Floating Container" in the **Rename Dashboard Item** dialog. Click **OK**.

3. Shift + drag **Show Legend** into the container. (Make sure the container is highlighted dark blue before dropping into the container.)
4. Click the **Show Legend** drop-down arrow then click **Select Container: "Floating Container"**.
5. Click the drop-down arrow on the container and select **Add Show/Hide button**.
6. Alt + click the button to hide the container.



7. Click the small **X** to remove the button from the dashboard.
8. In the **Dashboard** pane, select **Show dashboard title**.
9. Right-click the title, click **Edit Title**, delete the contents, click **Insert**, click **Parameters.Select Sheet**, and then click **OK**.

NOTE For an example of a complete solution to this practice, see **Bonus-Sheet Swapping and Containers Solution.twbx**.

10. Appendix C: Reference

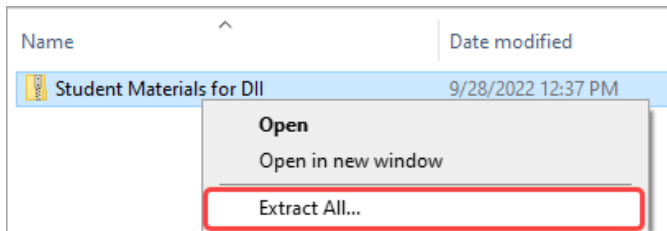
Working in the Desktop Application

If you are completing the practices for this course in the Tableau Desktop application, read the following to learn how to access and save the course materials.

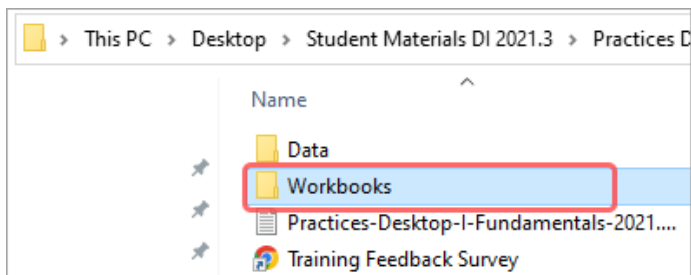
Working with .twbx Files in the Desktop Application

Some practices in this course have starter workbooks for you to use. All practices in this course also have solution files for you to compare against your own completed work. These files are the .twbx (Tableau Packaged Workbook) file type. Follow these directions to access them.

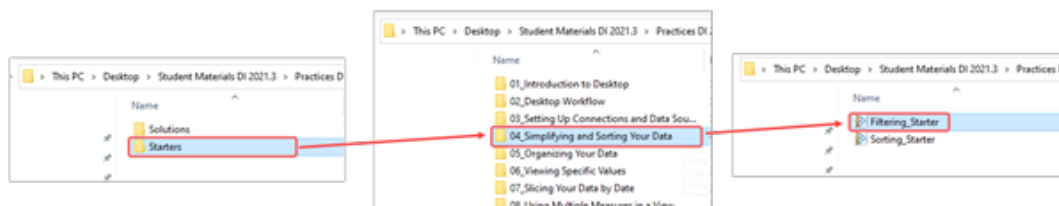
1. If you have not already done so, download the **Student Materials** zipped file, right-click, and select **Extract All** to unzip and save the files to your local computer.



2. Browse to the **Workbooks** subfolder within **Practices** in the **Student Materials** folder.



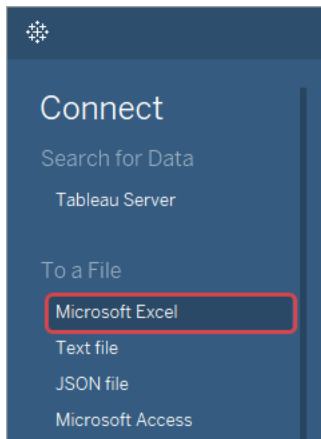
3. Open either the **Starters** or **Solutions** subfolder, and then browse to the module subfolder and the specific starter or solution file you want to open, for example, **Filtering_Starter.twbx**, found in the subfolder for the fourth module of the Tableau Fundamentals course.



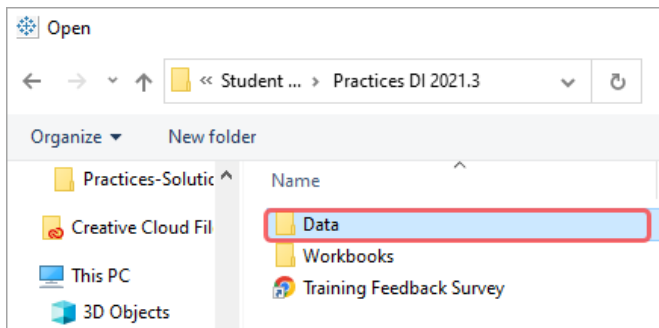
Working with Data Source Files in the Desktop Application

Many of the practices in this course will not contain starter workbooks, and will require you to connect to data source files from Tableau Desktop. Follow these directions to connect to data source files.

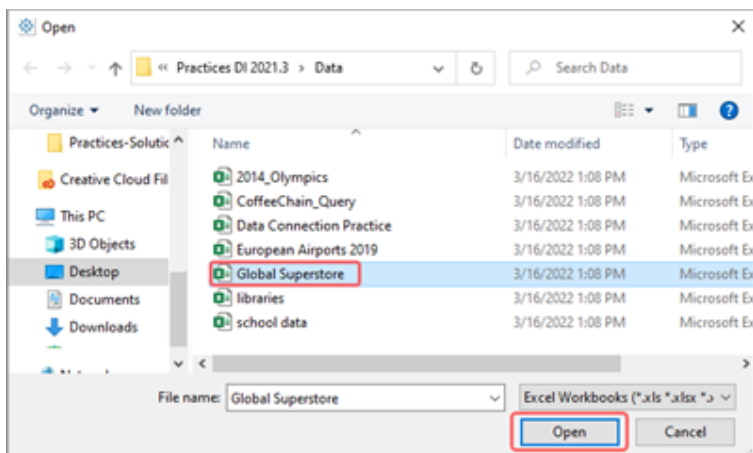
1. If you have not already done so, download the **Student Materials** zipped file, right-click, and select **Extract All** to unzip and save the files to your local computer.
2. Open Tableau Desktop, and under **Connect** click the file type used in the practice, for example, **Microsoft Excel**.



3. Navigate to the **Practices** folder within **Student Materials** and open the **Data** folder.

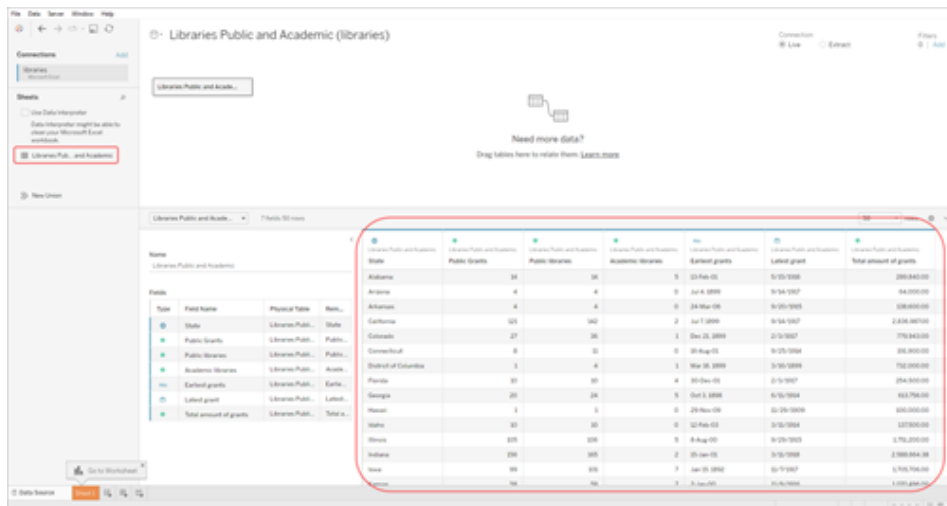


4. Open the file specified in the instructions for the practice, for example, **Global Superstore.xlsx**.

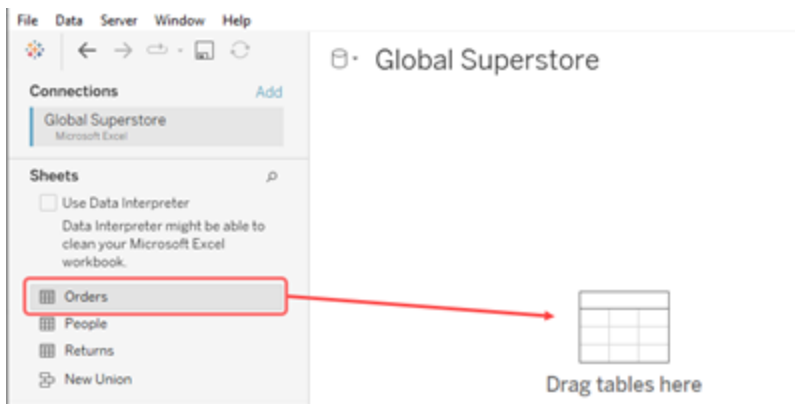


5. The **Data Source** page will automatically display in Tableau Desktop.

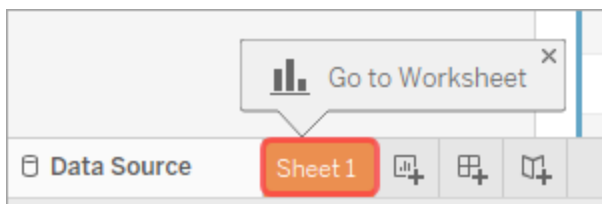
- If the file contains one table, you will see the data from that table in the data grid automatically.



- If the file contains multiple tables, on the **Data Source** tab, in the **Connections** pane under **Sheets**, double-click the table specified in the practice instructions (for example, **Orders**) or drag and drop it onto the **Drag tables here** area.

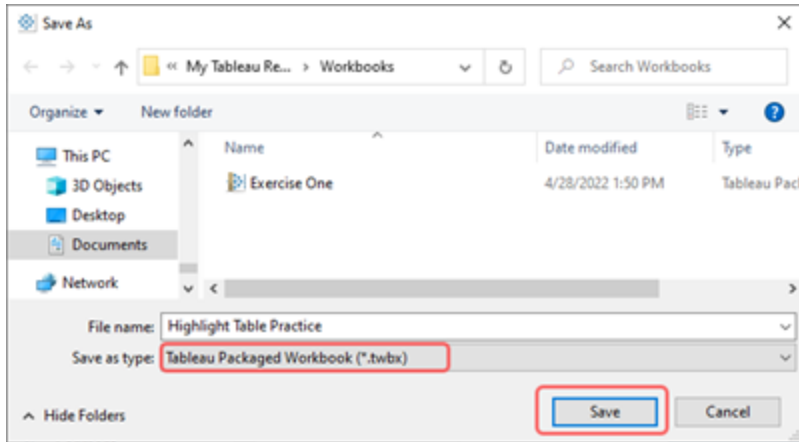


6. Click **Sheet 1** to go to the worksheet.



Saving Your Work in the Desktop Application

1. On the **File** menu of the workbook, select **Save** or **Save As**. Your work will automatically save to the folder **My Tableau Repository**.
2. In the dialog box, name your workbook, and select the .twbx file type (this will package the underlying data with the workbook).



3. Click **Save**.

You can also find instructions for working with .twbx and data source files in the Desktop application in the first few practices.

Working in the Browser

If you are completing the practices for this course in the browser from your Tableau site on Tableau Server or Tableau Cloud, read the following to learn how to access and save the course materials.

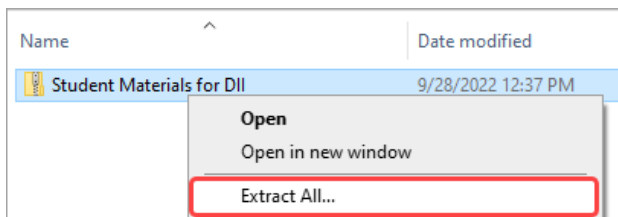
NOTE To complete the activities for this class in the browser, you must have a **Creator** site role and publishing permissions.

Working with .twbx Files in the Browser

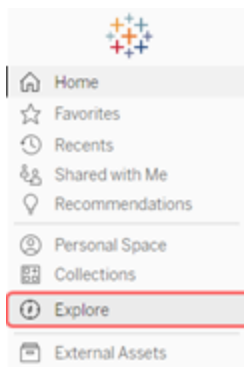
Some practices in this course have starter workbooks for you to use. All practices in this course also have solution files for you to compare against your own completed work. These files are the .twbx (Tableau Packaged Workbook) file type. Follow these directions to access them from the **Practices** folder and upload them to your Tableau site.

NOTE If you are on a company Tableau site or a site owned by another user, we highly recommend that you request a **Test** project be created that you can use for storing files and completing activities.

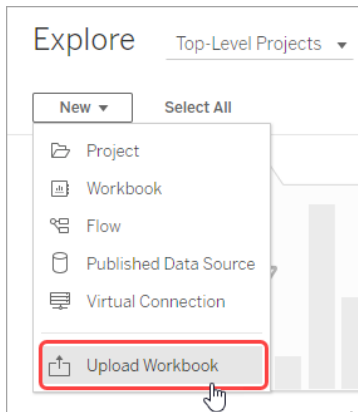
1. If you have not already done so, download the **Student Materials** zipped file, right-click, and select **Extract All** to unzip and save the files to your local computer.



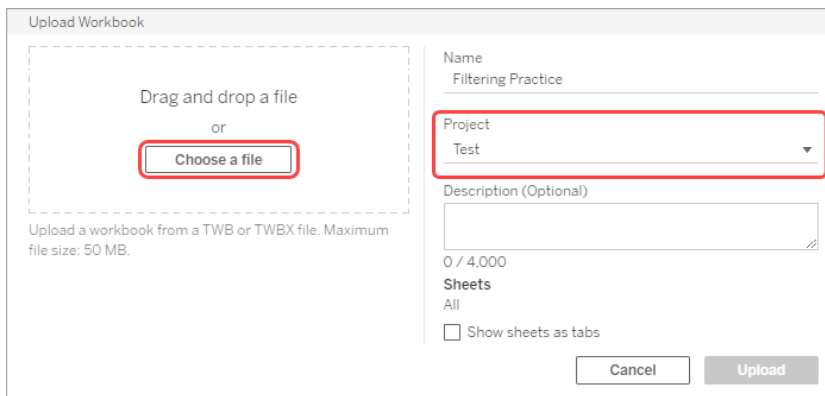
2. Log in to your Tableau site, and use the **Navigation** panel to navigate to the **Explore** page.



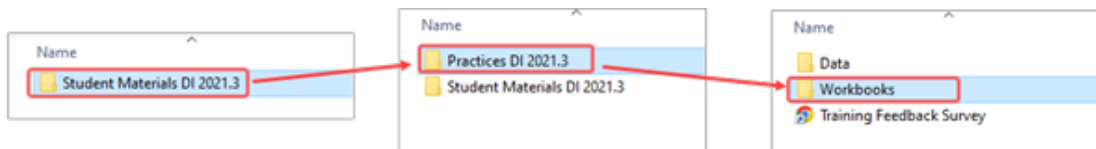
3. On the **Explore** page, click **New** and then click **Upload Workbook**.



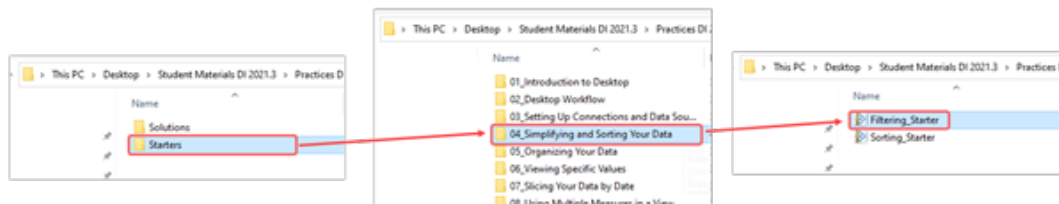
4. In the **Upload Workbook** dialog box, name the workbook under **Name**, and under **Project**, select a project where you have publishing permissions.
5. Click **Choose a File**.



6. Browse to the **Workbooks** subfolder within **Practices** in the **Student Materials** folder.

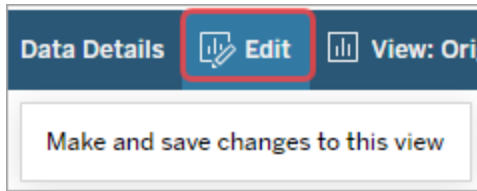


7. Open either the **Starters** or **Solutions** subfolder, and then browse to the module subfolder and the specific starter or solution file you want to open, for example, **Filtering_Starter.twbx**, found in the subfolder for the fourth module of the Tableau Fundamentals course. Click **Open**.



8. In the **Upload Workbook** dialog box, click **Upload**.

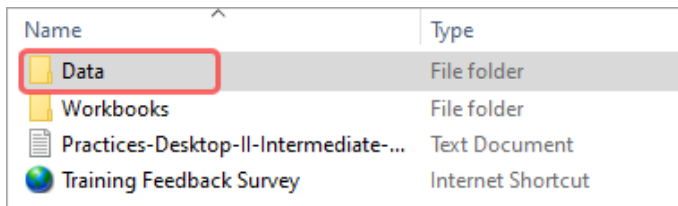
- The view will automatically open in Tableau. Click **Edit** on the toolbar to make the view editable so that you can complete the practice.



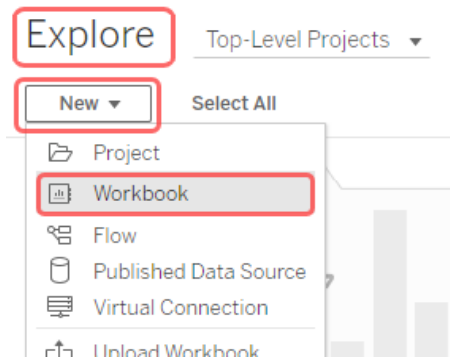
Working with Data Source Files in the Browser

If you're completing the practice exercises in the browser from your Tableau site, do the following:

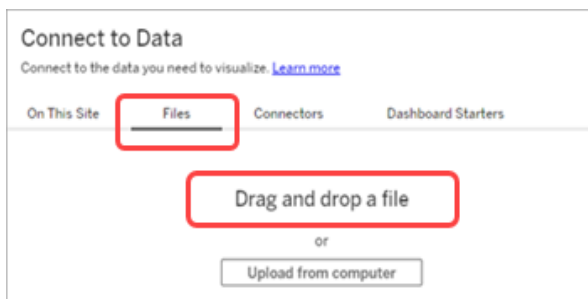
- Download the **Student Materials** zipped file, right-click, and select **Extract All** to unzip and save the files to your local computer.
- In the **Student Materials** folder, open the **Data** subfolder within **Practices**.



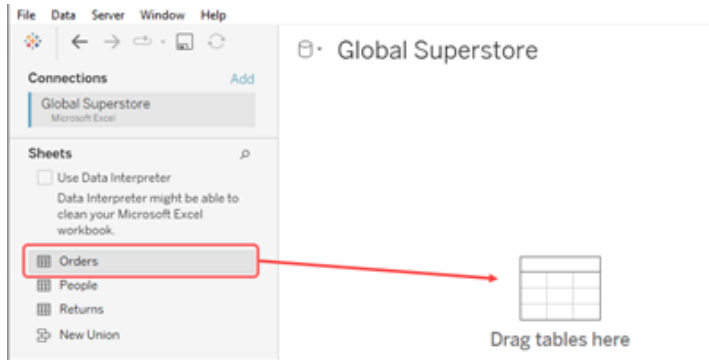
- On the **Explore** page of your Tableau site, click **New** and then click **Workbook**.



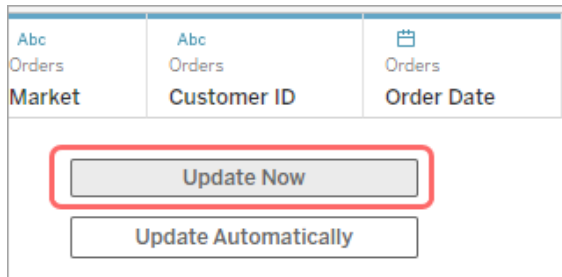
- In the **Connect to Data** dialog box, select the **Files** tab.
- From the **Data** subfolder of the **Practices** folder within **Student Materials**, drag the file specified in the instructions for the practice to the **Connect to Data** dialog box, and drop on **Drag and drop a file**.



- If the file contains one table, a workbook will automatically open to a new worksheet, and you can begin to follow the directions for the practice.
- If the file contains multiple tables, the **Data Source** page will open automatically. Complete the following:
 - On the **Data Source** tab, in the **Connections** pane, under **Sheets**, double-click the table specified in the practice instructions (for example, **Orders**) or drag and drop it onto the **Drag tables here** area.



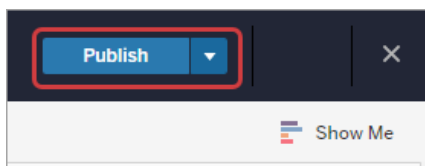
- In the data grid, click **Update Now** to populate it.



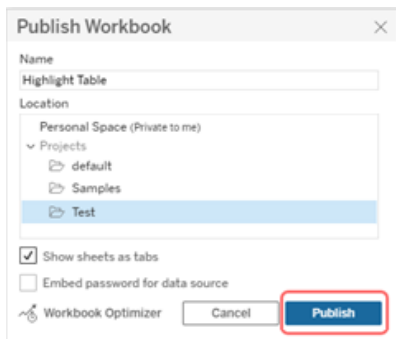
- At the bottom of the workbook, click the **Sheet 1** tab to open a new worksheet, and begin to follow the directions for the practice.

Saving Your Work in the Browser

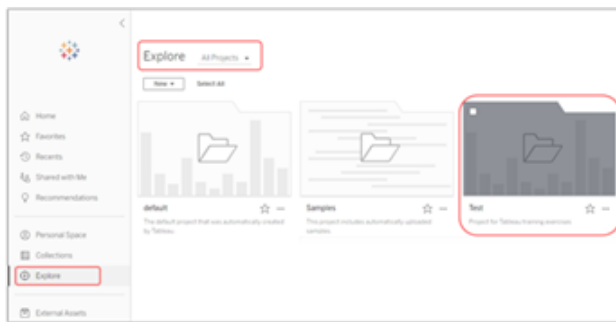
1. At the upper right corner of the screen, click **Publish**.



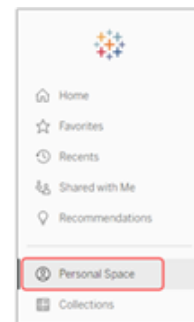
2. In the **Publish** dialog box, type a name for the workbook, select a project where you have publishing permissions (such as your **Personal Space** or a sandbox/test project), select the **Show Sheets as Tabs** checkbox (for workbooks with multiple worksheets), and click **Publish**.



3. To view the workbook on the site after publishing, navigate to the project where you published the workbook. (Use **All Projects** on the **Explore** menu and then click the project thumbnail to open a sandbox or test project, or select **Personal Space** on the **Navigation** panel to open your personal space).



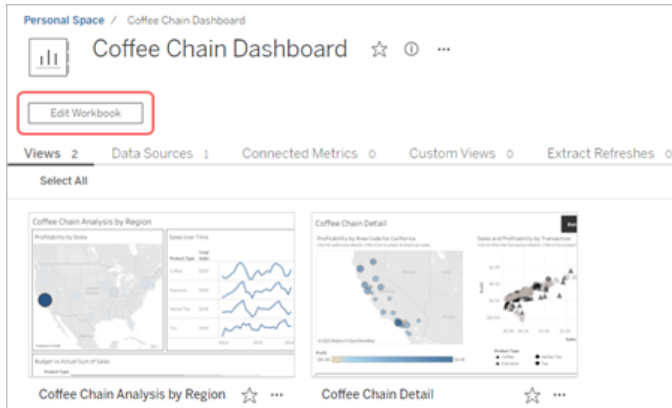
Navigate to a project



Navigate to Personal Space

4. Click the thumbnail for the published workbook to open its page.

- On the workbook's page, click the thumbnail to for the desired view (if more than one worksheet) to open the workbook, or click **Edit Workbook** to edit it.



You can also find instructions for working with .twbx and data source files in the browser in the first few practices.

Permissions in Tableau

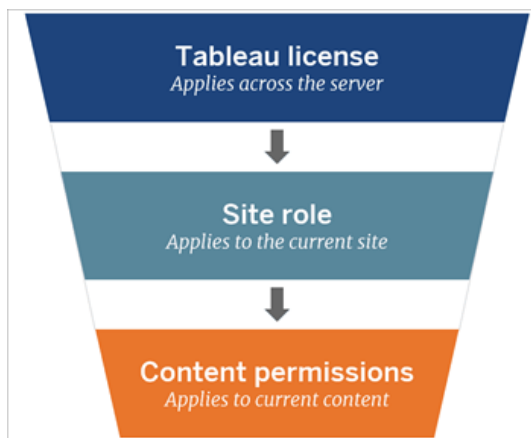
To complete the activities for this class in the browser, you must have at least a **Creator** site role and publishing permissions.

This topic introduces the permission structure for sites.

When working in the browser using Tableau Cloud or Tableau Server, there are three factors that impact what actions a user can perform:

- The Tableau license assigned to the user
- A user's current site role
- The actual permissions set on the content (projects, workbooks, data sources, and so on)

Together, these three factors form a user's capability hierarchy. At the top layer of the hierarchy is the Tableau license. The middle layer is the site role. The bottom layer is content permissions. As you work down the layers, a user's capabilities become more and more specific.



Top Layer: Tableau License

At the top layer of the capability hierarchy is the user's Tableau license. A user's Tableau license defines the maximum capabilities that a user can have anywhere on Tableau Server/Tableau Cloud, determines which site roles are available to that user, and corresponds to the highest-level site role assigned to the user.

A user can have only one of the following licenses on a server:

License Type	Description and Capabilities
Creator:	<ul style="list-style-type: none"> ■ Creators get access to Tableau Prep, Tableau Desktop, and Tableau Server/Tableau Cloud as standard. ■ Creators make new connections to data in the browser and create new content in the browser using data sources they publish or data sources already published to the site.
Explorer and Explorer (can publish)	<ul style="list-style-type: none"> ■ Explorers interact with, edit, and use published visualizations on Tableau Server/Tableau Cloud. ■ Explorers create new workbooks using data sources already published to a particular site, but they cannot publish data sources. ■ Explorers (can publish) can save workbooks they create.
Viewer	<ul style="list-style-type: none"> ■ Viewers can see published and custom views others have created. ■ Viewers can interact with the data in a view using filters and legends, sorting, and tooltips. ■ Viewers are unable to create content.

Middle Layer - Site Role

In the middle layer of the capability hierarchy is the user's current site role. Site roles are defined by the user's license, define the maximum capabilities that a user can have on the current site, and can vary from site to site.

A user can have only one of the following site roles per site:

Capability Level by License Type	Site Roles
Maximum site roles for Creator license	<ul style="list-style-type: none"> ■ Server Administrator (Tableau Server only) ■ Site Administrator Creator ■ Creator
Maximum site roles for Explorer license	<ul style="list-style-type: none"> ■ Site Administrator Explorer ■ Explorer (can publish) ■ Explorer
Maximum site role for Viewer license	<ul style="list-style-type: none"> ■ Viewer

Bottom Layer - Content Permissions

At the bottom layer of the capability hierarchy are the content's permissions.

In a site, each piece of content has its own permissions.

A content's permissions consist of a combination of capabilities that have either been granted or denied to a specific group or user.

Content permissions:

- Combine with a user's site role to define the specific capabilities that a user can have with that content.
- Vary from resource (project, workbooks, views, data sources, flows, data roles, and metrics) to resource.

Navigating a Tableau Site

If you plan to complete activities for this course in the browser, using a site on Tableau Cloud or Tableau Server, this topic will provide a basic introduction to navigating a Tableau site.

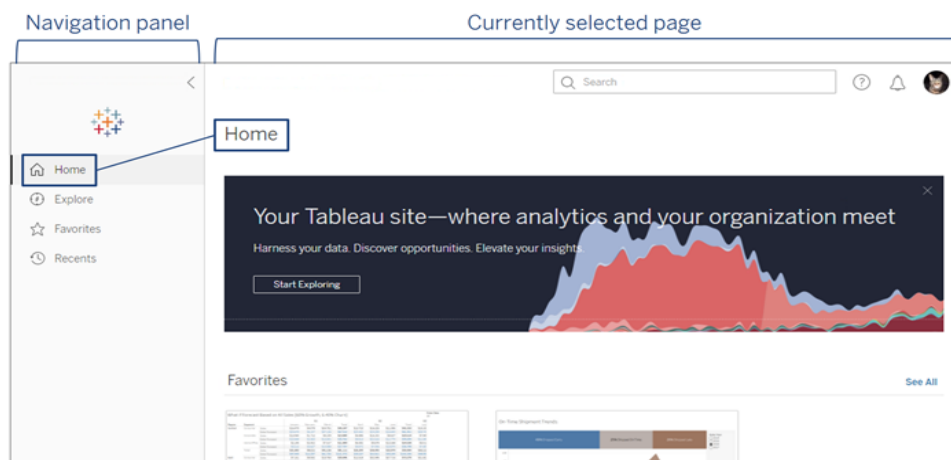
On Tableau Cloud or Tableau Server, you can create and edit visualizations in the browser, without Tableau Desktop. Creators and Explorers with publishing permissions can also save the visualizations they create to share with others. Creators can also publish data sources for others to use.

You complete all the tasks listed above in your Tableau Site on Tableau Server or Tableau Cloud. Once you receive your account information from your Server or Site Administrator, and you log in, you'll find that the user interface has many built-in features that make it easy to navigate.

The User Interface

The user interface has two main sections:

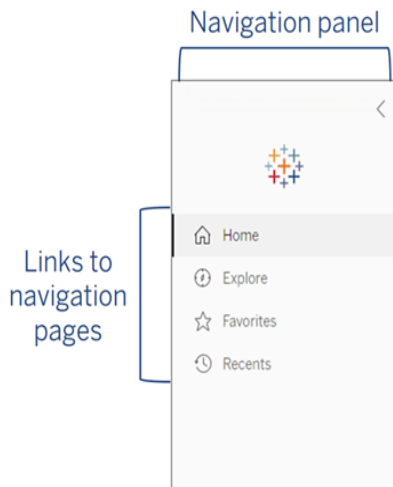
- The navigation panel on the left side.
- The currently selected page on the right side. The first page you see is the **Home** page. The **Home** page gives you quick access to newly added favorites, recently visited views, and popular content.



The Home page selected in the Navigation Panel (left) and displayed (right)

The Navigation Panel

The left navigation panel lets you quickly jump between important navigation pages on your site. Use the navigation panel to quickly link to a navigation page to start your content exploration.



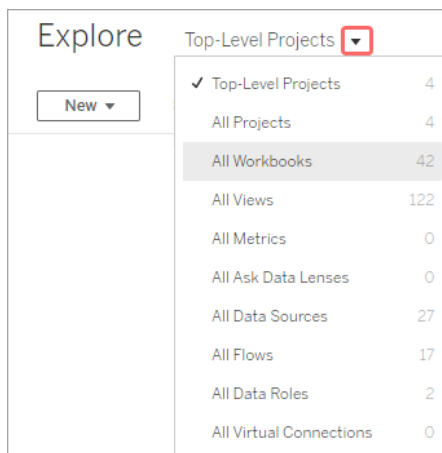
The Explore Page

To see all of the content you have access to, select **Explore** from the navigation pane. On the **Explore** page, you can create new content as well as see all the content on your site in one place. You'll also find a number of features to help you find the content you need.

- **Content type menu:** Navigate to the content on the site, such as a project, view, or a data source.
- **Quick search:** Use keywords to quickly search for a view or a project.
- **Your content and settings:** Determine your permission and access level to the content on the site.
- **Filtered search:** Search for content on the site using various filters.

Content Types on a Tableau Site

Use the content type menu from the **Explore** page to select different content types.



Some of the most common content types include:

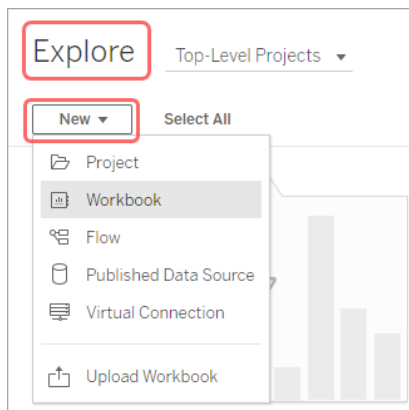
- **Projects:** Projects are a way to organize the content on your site. Top-level projects can contain other (nested) projects, forming a hierarchy that you navigate like the file system on your computer. When you open a project, you see all of the content that the project contains on a single page, including any nested projects, workbooks, data sources, and so forth.
- **Workbooks:** Workbooks are packages of views. A workbook page shows the views included in the workbook and the data sources used by the workbook. It also provides a list of user subscriptions to either the workbook or to individual views.
- **Views:** A view page displays options for interacting with the view, including sharing and editing.
- **Data Sources:** A data source page shows connections to databases or file-based data, as well as the workbooks connected to the data source.

Creating New Content from the Explore Page

Create new content directly from the **Explore** page by clicking the **New** button and selecting the content type from the menu.

The options on this menu allow you to create a new project, workbook, or flow, or to upload a workbook to then author on the web, depending on your site role.

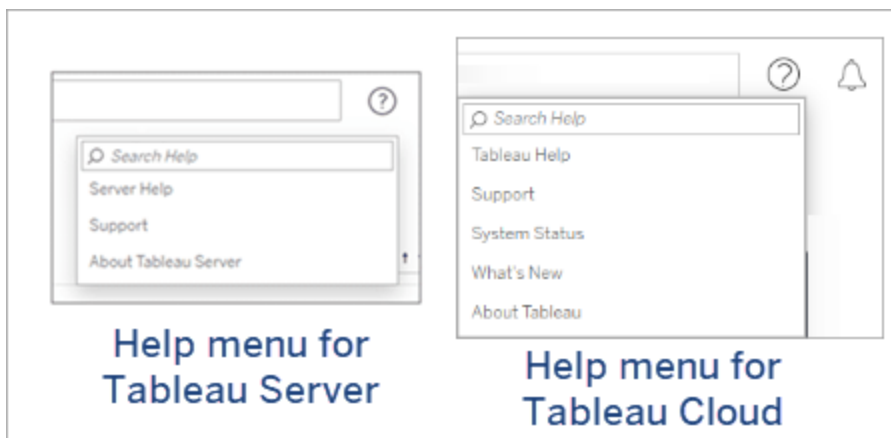
- Only administrators can create projects.
- Creators and administrators can create workbooks and flows using published or uploaded data sources.
- Explorers, creators, and administrators can upload existing workbooks or create new workbooks using published data sources.



Finding Help

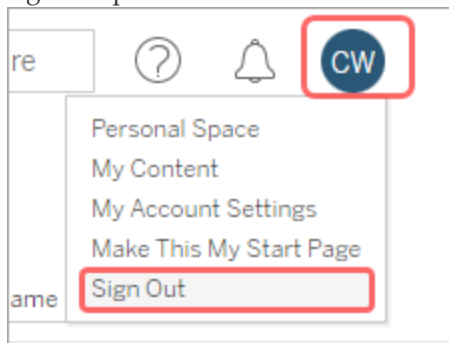
To open the **Help** menu, click the "?" icon in the upper-right of the user interface. The **Help** menu provides the following options:

- A search box that you can use to search the Tableau Support site (link opens in a new tab) for a given term or terms. After entering your search term, press **Enter**, and you'll immediately go to a list of appropriate search results on the Tableau Support page.
- **Tableau Help** opens the online help content for Tableau Server or Tableau Cloud.
- **Support** opens the Tableau Support site where you can explore support by product, submit a support case, download drivers, or download Tableau products.
- **What's New** (available only on Tableau Cloud) opens the Tableau Cloud Release Notes page, where you can see what the latest online features are.
- **About Tableau** displays the version and build number for the current instance.



Signing Out of Your Tableau Site

When you are done interacting with data and finding great data insights, it's time to sign out. To sign out, click your profile image or initials in the upper right corner, and select **Sign Out**. Be aware that the sign-out process is immediate. You will not be prompted for a confirmation.



Accessibility Compliance

Accessibility typically describes how easily someone with a disability can use or access a system, such as a website or a software application. Incorporating good design practices (listed below) into your visualizations can benefit all users, regardless of ability, and can help make your workbooks and dashboards more effective and easy to use.

However, to create views that are compliant with accessibility requirements, for example, the Web Content Accessibility Guidelines (WCAG 2.0 AA) and U.S. Section 508 requirements, you must follow these steps:

1. Create views in Tableau Desktop following best practice guidelines.
2. Publish the views to Tableau Server or Tableau Cloud.
3. Embed the views in an accessibility-compliant web page for users to access the content.

These embedded views will be accessible to users who operate assistive technology, such as screen readers, and/or use accessibility techniques such as keyboard-only navigation.

Accessibility Principles

The WCAG principles help support authors to create accessible visualizations.

WCAG 2.0 AA Principle	Description
Perceivable	Information and user interface components must be presented to users in a way that they can perceive. Consider including text alternatives and alternate ways to present the content.
Operable	The user interface components and navigation must be accessible to users from the different devices or methods that they use to interact with the view. This is accomplished by publishing your view to Tableau Server or Tableau Cloud and then embedding your view in an accessibility compliant web page.
Understandable	The information presented in the view must be understandable to your users. For example, using clear names and labels for different elements shown in your view.

Best Practices

When creating your views, follow these guidelines:

Guidelines	Principles	Technique Examples
Keep it simple	Understandable	Limit the number of marks. Orient labels and headers horizontally for legibility. Limit the number of colors and shapes.
Show more text and make it helpful	Perceivable, Understandable	Provide descriptive text in titles and captions to provide context. Use mark labels. Add explanatory text.
Use color thoughtfully and provide contrast	Perceivable, Understandable	Select the color-blind palette for dimensions or discrete marks. Use the blue or orange-blue diverging palette with stepped color for measures or continuous marks. Use contrast analyzer tools to select the text and color backgrounds with sufficient contrast ratios of 4.5:1 (large text 3:1)
Provide visual cues beyond color	Perceivable, Understandable	Use additional encoding, such as size and shape, to differentiate marks. Identify spatial relationships of marks using location, for example, with reference lines, trend lines, calculated fields to identify quadrants. Add mark labels to help distinguish marks, for example line endpoints and/or minimum and maximum values.

More Information

For more information on these topics and the common keystrokes for navigation in a Tableau embedded view, please search for "accessibility compliant" in Tableau Help.

Further Assistance

Want to learn more? Tableau offers a variety of training and enablement solutions designed to meet the needs of your organization.

eLearning

With guided, role-based learning paths, Tableau eLearning allows you to easily educate your team in a consistent and scalable way. Learning paths help users learn the ins and outs of Tableau at their own pace, when their schedules allow. Skills assessments, knowledge checks, and hands-on activities ensure that information is retained.

To find out more, visit tableau.com/learn/learning-paths.

Classroom Training

Classroom training offers in-depth learning experiences with expert instructors. Training is offered across the globe, at your location or in virtual classrooms.

To find out more, visit tableau.com/learn/classroom.

Consulting

Tableau consultants deliver a wide range of services, including remote coaching sessions, on-site rapid deployments, and ongoing consulting to enable Tableau adoption at your organization.

To find out more, visit tableau.com/support/consulting.

Other resources

Knowledge Base—Access a compilation of the top online resources for different topical areas at tableau.com/support/knowledgebase.

Community Forums—Explore a place to connect with other users and find answers to your Tableau-related questions at tableau.com/community.

Tableau Blueprint—Discover an enablement framework for becoming a data-driven organization at tableau.com/blueprint.

Whitepapers—Access a library of whitepapers covering data visualization, best practices and industry trends at tableau.com/learn/whitepapers.

Tableau Viz Gallery—See the possibilities when visualizing data in Tableau at tableau.com/solutions/gallery.

Tableau Public—Explore how users are building unique, informative stories with their data with Tableau Public. Visit public.tableau.com/s/.

Sample workbooks—Access workbooks through Tableau Desktop by clicking on the **Help** menu and selecting **Sample workbooks**.

Technical Support—Search for an answer in the support resources and if you don't find an answer, create a support case at tableau.com/support.

Ready to Test Your Skills?

Show off your Tableau knowledge and experience by earning badges. Our skills assessments and certification programs test a wide range of skills, whether you're just beginning or an expert.

Skills Assessments

Skills Assessments help determine whether you have the necessary skills to be productive in your Tableau role. You can access skills assessments through Tableau's eLearning platform. Users in every Tableau role in your organization can pass one of these low-stakes assessments and earn a Skills Badge to build confidence in their skills.

To find out more, visit tableau.com/learn/learning-paths.

Certification

Build your resume, advance your career, and showcase your skills by becoming #CertifiablyTableau. Tableau Certification allows you to communicate your skills confidently and clearly and to join a community of skilled Tableau users.

Exam	Exam Focus
Tableau Desktop Specialist	Prove your core understanding of Tableau Desktop.
Tableau Certified Data Analyst	Prove you can solve business problems with the power of the Tableau Platform.
Tableau Server Certified Associate	Prove your Tableau Server and site administration skills.

To learn more about the exams, visit tableau.com/learn/certification.

Training Feedback Survey

Our training team relies on customer feedback from students to evaluate performance and help improve our educational offerings. Please take five minutes after class to complete a brief but important online survey to share your thoughts on the instructor, the training environment, and the learning materials.

Survey Link

To open the survey on your computer, either click the **Training Feedback Survey** link in the **Practices** folder, or navigate to: <https://www.tableau.com/training-csat>

NOTE Be sure to enter the class code provided by your instructor, and the email address you used to register for the class.

For Mobile Devices

To complete the survey on a mobile device, point your device's camera at the QR code below.

