Lab 5: Combining Data

In this lab, you'll find the following exercises to help you combine your data for analytics:

- Combining data with Union
- Combining data ingest and Union actions
- Combining datasets using an inner join
- Combining datasets using a left or right join
- Expanding datasets using a full outer join
- Expanding datasets using a not inner join

Technical requirements

To follow along with the exercises in this lab, you will require **Tableau Prep Builder**. The exercises in this lab use sample data files that you can download from the course GitHub repository at https://github.com/fenago/tableau-data-prep.

Combining data with Union

Data is typically produced by multiple systems and certain systems may produce similar data that needs to be combined vertically. That is, the rows need to be stacked on top of one another. A use case we'll use in this exercise is combining sales data from two different sales systems, in order to get the total sales dataset prepared. This is a typical scenario you may encounter when your organization is operating multiple systems, is migrating from one system to another, is maintaining legacy systems, or is integrating systems from a partner or acquired company. In this exercise, we'll combine multiple datasets using Union.

Getting ready

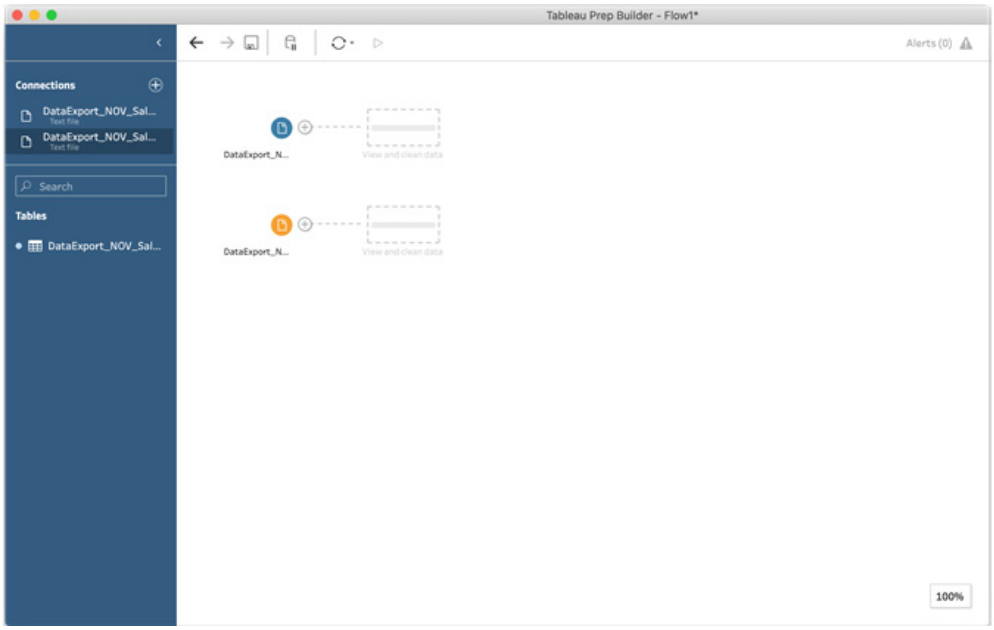
To follow along with this exercise, download the **Sample Files 5.1** folder from this course's GitHub repository.

How to do it...

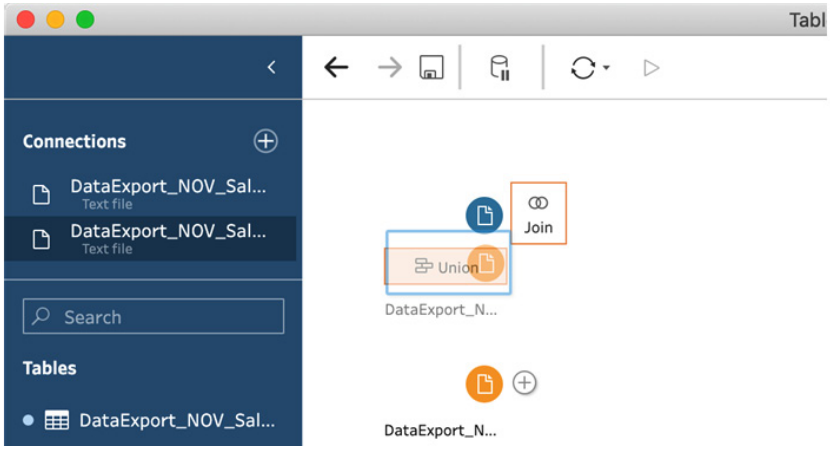
Start by opening **Tableau Prep** and perform the following steps:

1. Connect to the **DataExport_NOV_Sales.csv** text file in order to create a brand-new flow with a data connection. Let's assume that this is data from a legacy sale system, where each row represents a sale made.

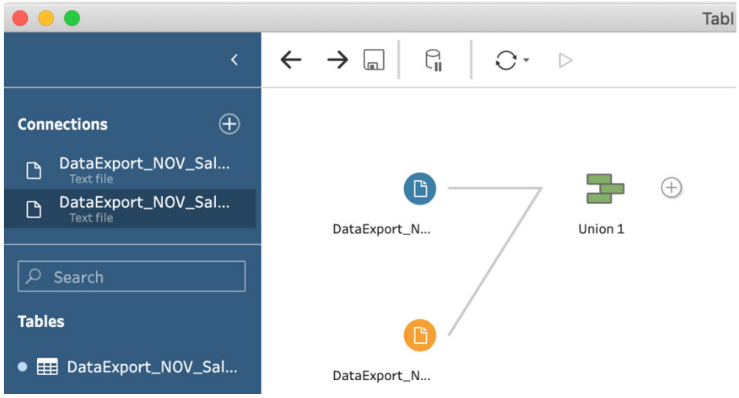
2. Create a second data connection to the **DataExport_NOV_SalesData.csv** text file. This data is from the same legacy system, but it may reside on a separate server, resulting in the need for a separate connection here:



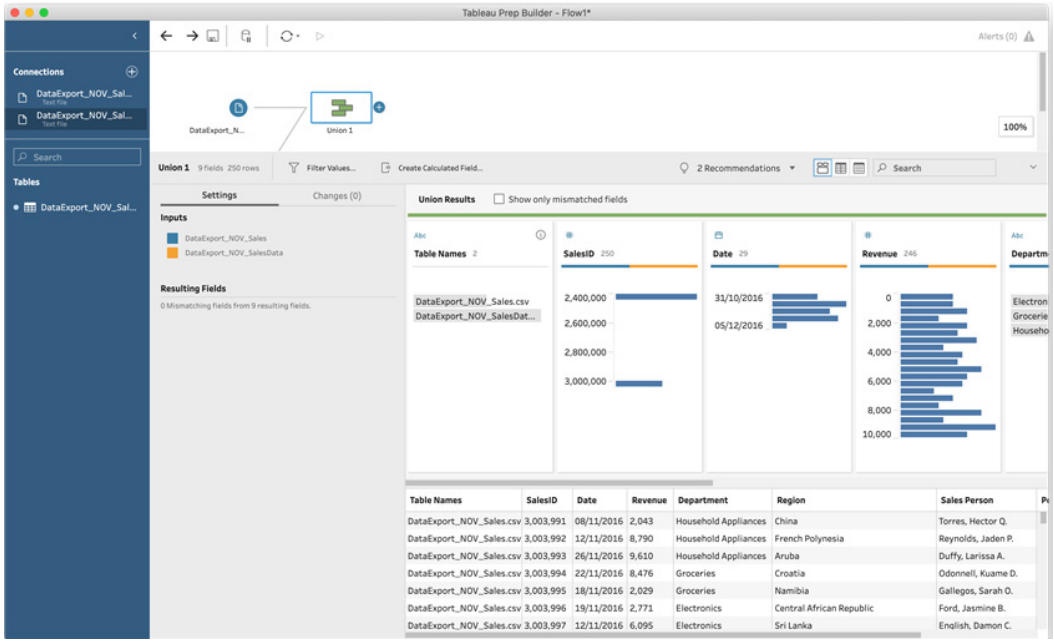
3. We'll now need to combine data from both connections in order to get a complete picture of all sales made. To do so, we're going to union these two data inputs. To do so, click and hold the second data input and then drag it on top of the first data input. When you do so, you will see two options appear, **Union** and **Join**:



Drag the connection so that **Union** is highlighted, and then release. Tableau Prep will instantly add a step named **Union 1**:



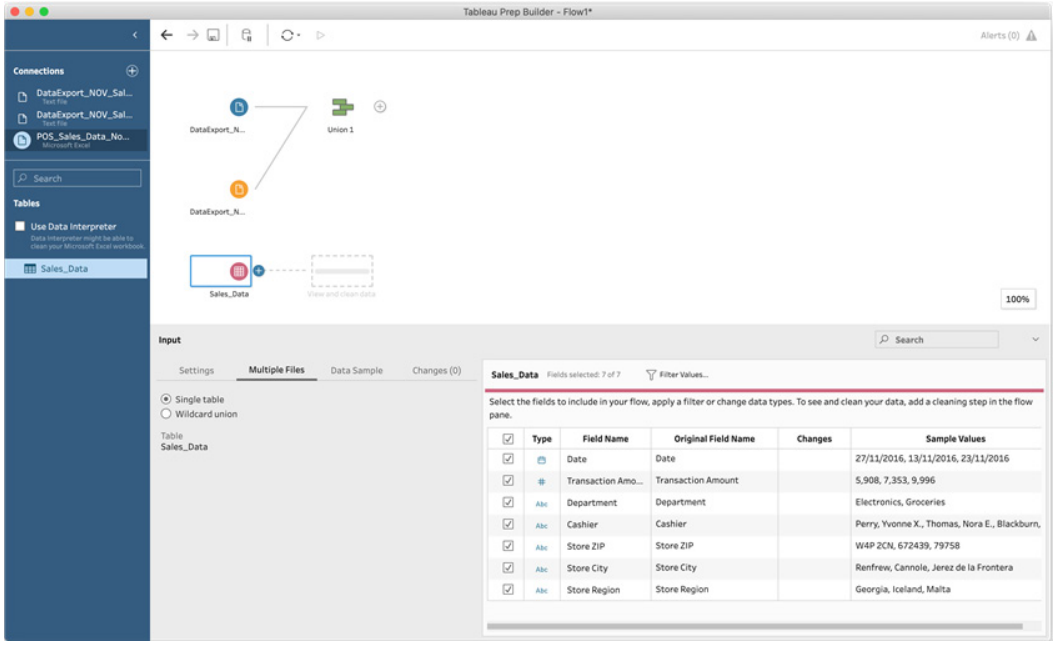
4. Select the **Union 1** step to view the data pane at the bottom of the screen. Expand the bottom pane so that the data preview becomes visible. Notice how a new field has been added automatically, named **Table Names**. This field indicates the original source of each row in the combined dataset. You can scroll through the preview to see both values, **DataExport_NOV_Sales.csv** and **DataExport_NOV_SalesData.csv**:



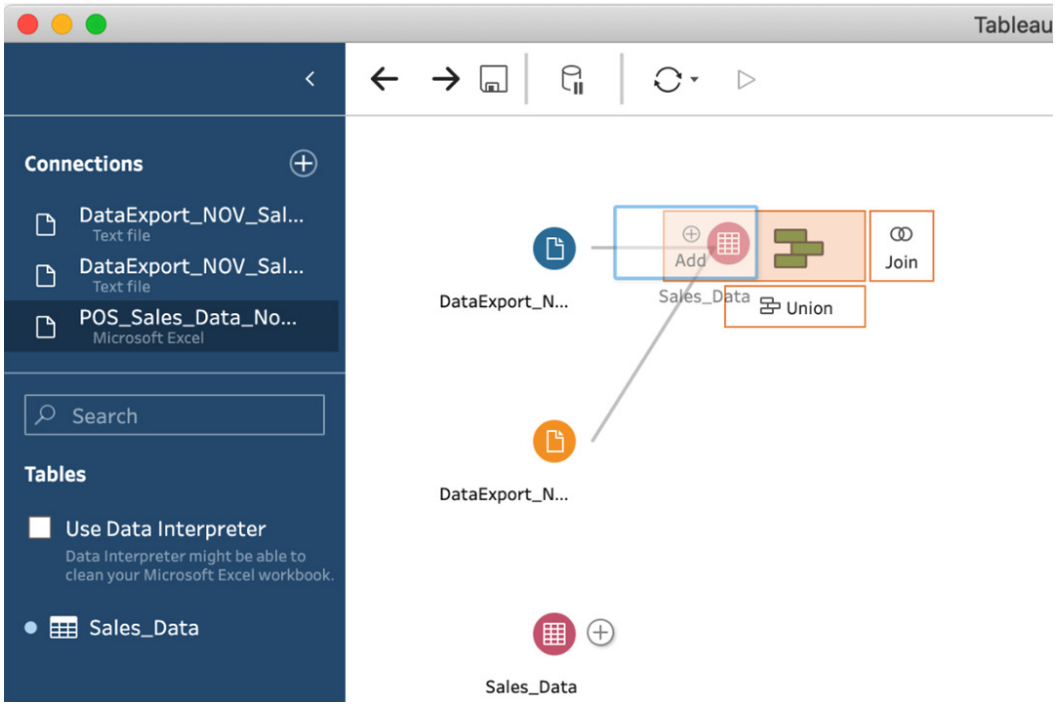
Important note

In the bottom pane, take note of the two colors Tableau Prep has assigned to each data connection; blue for **DataExport_NOV_Sales.csv** and amber for **DataExport_NOV_SalesData.csv**. Observe the column headers and notice the multi-colored bar beneath all the field names, with the exception of the **Table Names** field. This multi-colored bar indicates from which data connection the field was sourced. In our case, all bars are a combination of blue and amber, meaning data was sourced from both data connections.

5. Now let's add a third data connection to your flow. This time, connect to the **POS_Sales_Data_November_2016.xlsx** file, specifically, the **Sales_Data** sheet. This data is from a completely different sales system. As a result, the data in the file is organized differently from the two connections we've used so far. Observe the input field names by selecting the input step:

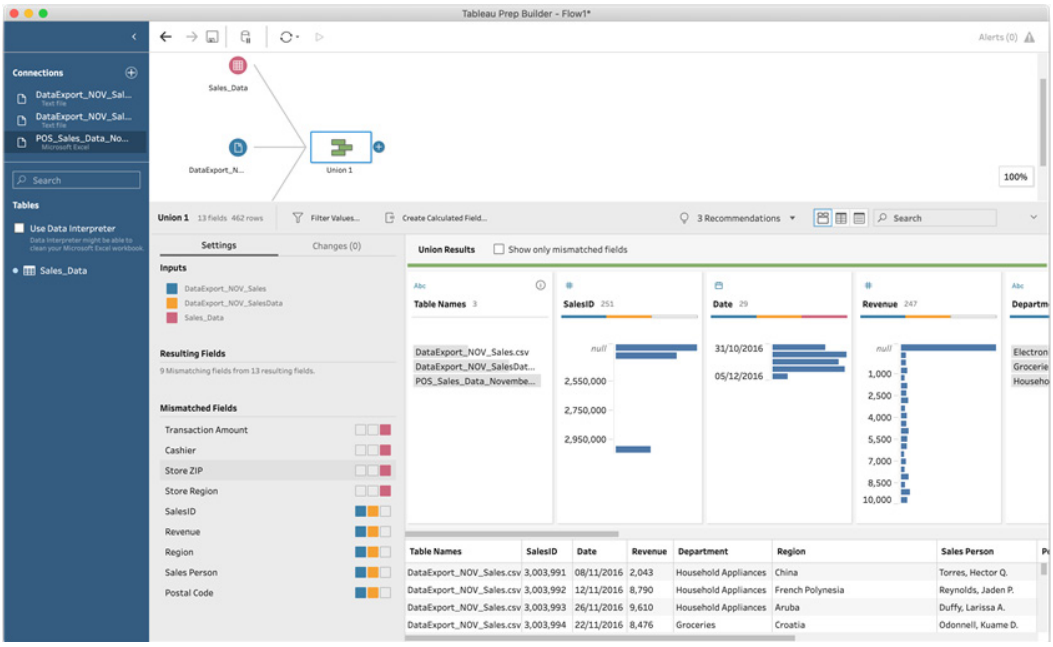


6. Even though we've observed different field names, we can still stack this data with the existing connections, using **Union**. Go ahead and drag and drop the **POS_Sales_Data_November_2016.xlsx** input on top of the **Union 1** step. Notice how this time, three options appear when hovering, instead of the two options we saw in *Step 3* earlier. We have **Add**, **Union**, and **Join**:



Hover to the left to highlight the **Add** action and release the mouse button. This will add the third source to your existing union. If you have selected **Union** instead, a second union step would have been created, combining **Union 1** with the third data connection.

7. Select the **Union 1** step to view the bottom pane. Notice how you can use the color coding to quickly find potential issues with the union. The **Inputs** section now defines three colors; blue for **DataExport_NOV_Sales.csv**, amber for **DataExport_NOV_SalesData.csv**, and red for our newly added **POS_Sales_Data_November_2016.xlsx** connection:



Using the same color bars we described in *Step 4*, you can quickly see the origins of each field. For example, **SalesID** is blue and amber, meaning it contains data from those two data connections. That is, the **SalesID** field does not exist in the **POS_Sales_Data_November_2016.xlsx** data connection. Similarly, the **Date** field has three colors -- blue, amber, and red -- indicating the field is present in all three inputs.

8. The **Mismatched Fields** section uses color coding to inform us of the field origins, similar to the multi-colored bar under each field name. There are some fields that contain similar data, such as **Store Region** and **Region**. However, because the field names in the data connections are different, Tableau Prep was unable to align them in a single field. To solve this issue, we can simply rename the fields:

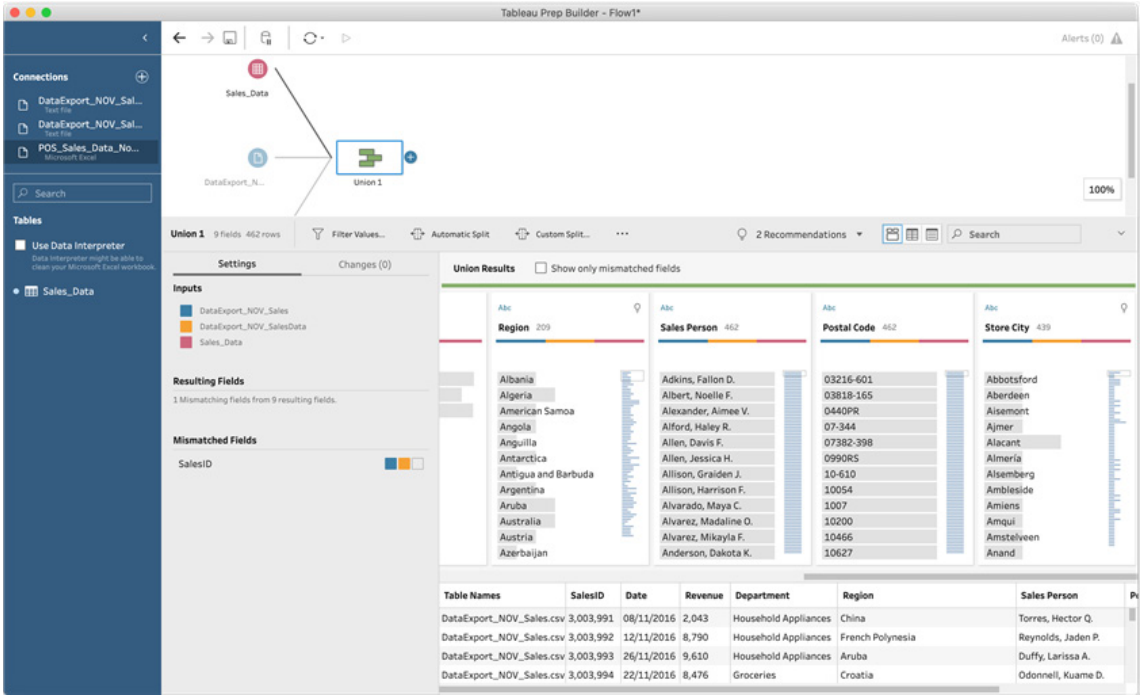
   Rename **Transaction Amount** to **Revenue**.

   Rename **Cashier** to **Sales Person**.

   Rename **Store ZIP** to **Postal Code**.

   Rename **Store Region** to **Region**.

   The following screenshot illustrates the end result, where fields have automatically been merged as a result of renaming field names:



As you can see, Tableau Prep automatically and instantly re-aligns the fields once they have identical names. In our case, we have one field remaining that is not present in the **POS_Sales_Data_November_2016.xlsx** data connection -- **SalesID**. This is not an issue for the union step. The field will be retained, and any rows originating from the **POS_Sales_Data_November_2016.xlsx** data connection will have a null value for that field.

How it works...

Tableau Prep stacks rows from any input to a union on top of each other and aligns the data by field names at the same time. In our exercise, we've resolved two scenarios. First, we combined data from two similar, but separate, data connections. In this case, Tableau Prep combined the data without any issues. Then we combined data that was significantly different, that is, data with a different number of fields, and different field names. Tableau resolves this by setting the value to null for fields that are not present in a certain input, and we can manually rename fields in order to trigger Tableau to align them.

Combining data ingest and Union actions

When you have multiple data sources that need to be vertically stacked using a union, you may opt to perform that action during ingestion. This avoids you having to create a separate **Union** step in Tableau Prep. Furthermore, you can use wildcards in your input, such that the input becomes dynamic, and new data files can be ingested as they are added. A typical scenario for this would be an automated process that exports data on a recurring schedule, which you then need to union with prior data exports.

In this exercise, we'll use a special type of union that is part of the input step, rather than a step by itself. Using the **Union** functionality during input allows you to ingest and union multiple input files simultaneously.

Getting ready

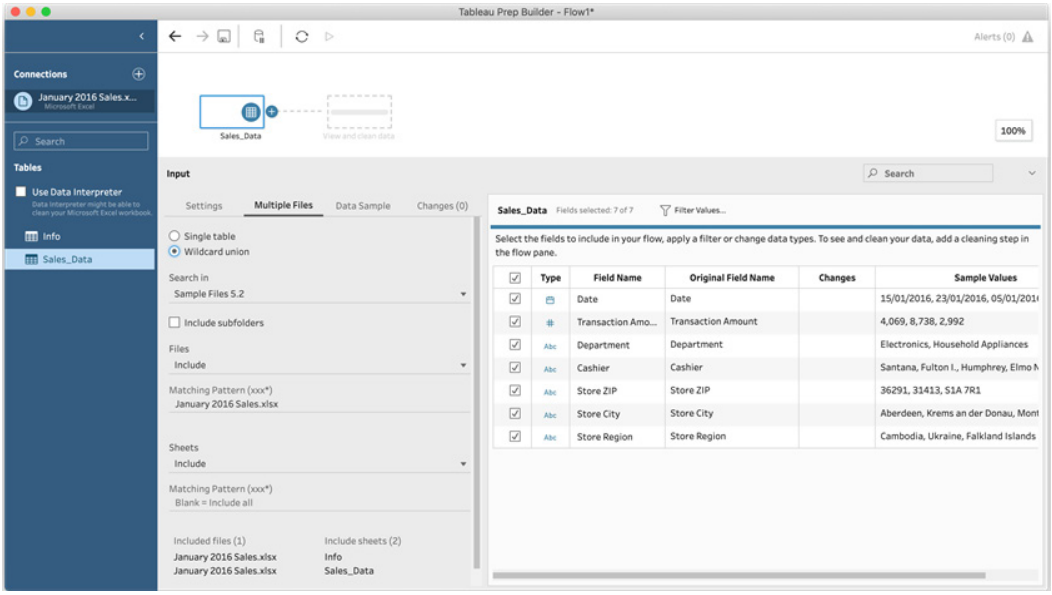
To follow along with this exercise, download the **Sample Files 5.2** folder from this course's GitHub repository. This folder contains sales data that has been exported every month, and so we have one file for every month of the year

2016, 12 files in total, to be combined using a union.

How to do it...

Start by opening Tableau Prep and perform the following steps to create a dynamic input and union step:

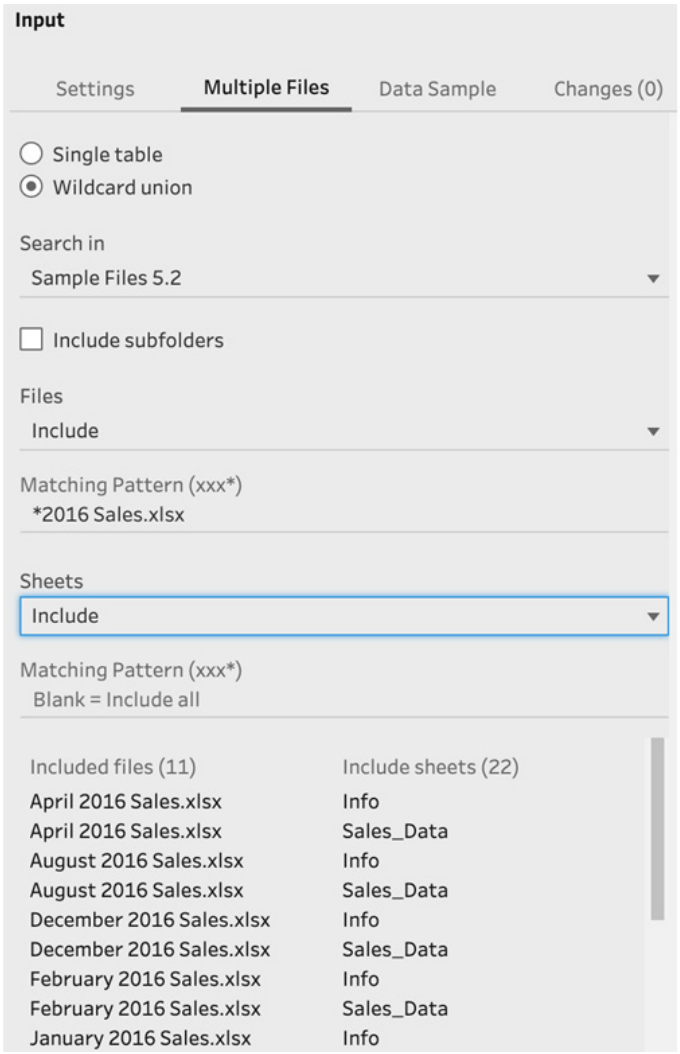
1. Connect to the **January 2016 Sales.xlsx** Excel file in order to create a brand-new flow with a data connection.
2. From the available tables, drag the **Sales_Data** table onto the flow canvas. Then, select the input step in order to display the bottom pane. From the pane, select **Multiple Files**, followed by **Wildcard union**:



Wildcard union allows you to perform a union within the input data connection. That is, you can union multiple files at the same time. Wildcards, represented by the asterisk, *, symbol, are utilized to refer to any number of files in a given directory that match a certain naming pattern.

In this exercise, we will perform a union to combine all 12 Excel files in the sample folder.

3. By default, **Matching Pattern** is identical to the filename of the current connection, in this case, **January 2016 Sales.xlsx**. To capture all files in the directory, we can replace any number of characters using a wildcard. Set **Matching Pattern** to ***2016 Sales.xlsx**. This will instruct Tableau Prep to include every file ending in **2016 Sales.xlsx**. In this example, we've replaced the month with a wildcard, and hence all 12 files are now in scope.
4. Once you've set the **Matching Pattern** field, Tableau Prep will immediately scan the files in scope, and identify the sheet names per file. You will be presented with a full list of file and sheet names under **Sheets**. Notice how each file from our sample data contains two sheets, **Sales_Data** and **Info**:

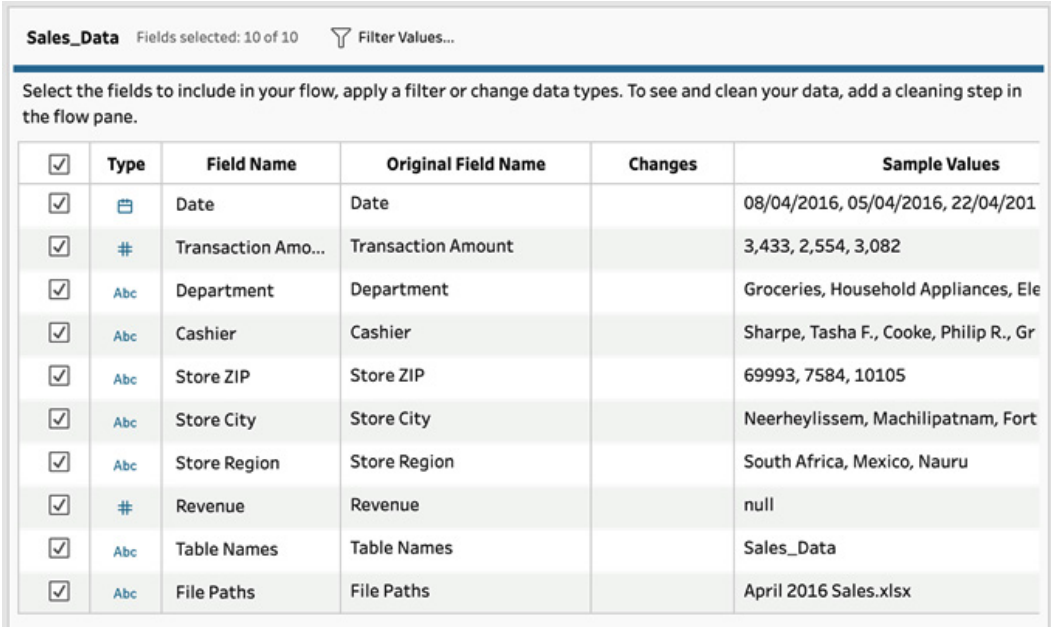


The data we want to capture resides in the **Sales_Data** sheet. As such, we need to provide a matching pattern for sheets, so that only the sheet carrying that name will be included. Since the sheet names are identical, we can achieve this without a wildcard.

Note that we can set our **Matching Pattern** behavior to **Include** or **Exclude**. Using the dropdown highlighted in above figure, by setting this option to **Exclude**, you can specify the **Matching Pattern** value as **Info**. In doing so, you're instructing Tableau Prep to exclude all sheets named **Info**.

5. To confirm the settings, make sure to click the **Apply** button at the bottom of the pane. Depending on your screen size, this button may not be visible initially. Scroll down to the bottom to reveal the **Apply** button and click it.

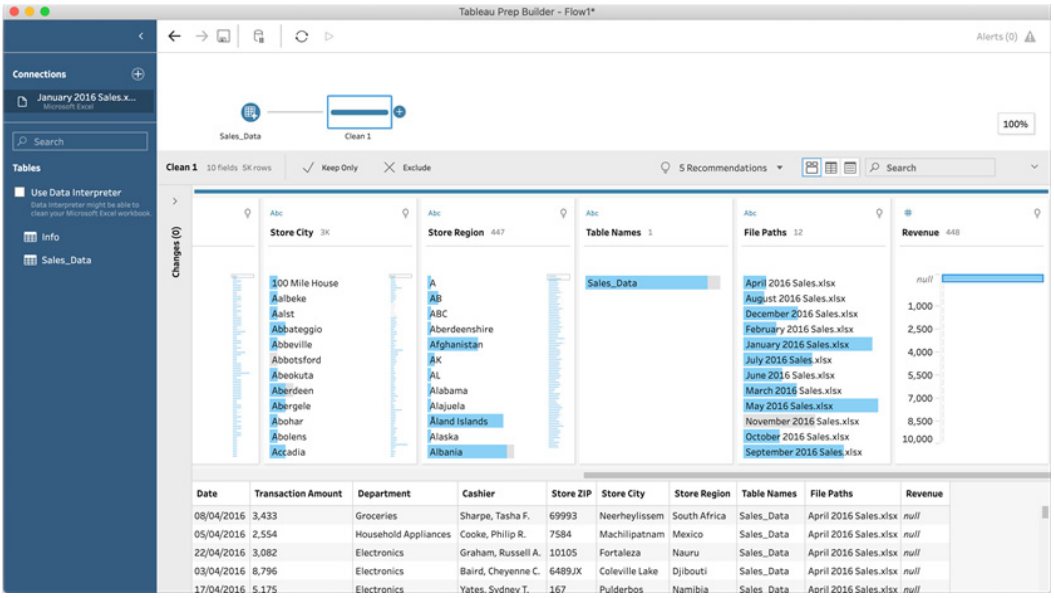
6. After applying your changes, Tableau Prep will provide a list of field names found across all the files in scope. Furthermore, it will provide us with a preview of values per field in the bottom pane:



Type	Field Name	Original Field Name	Changes	Sample Values
Date	Date	Date		08/04/2016, 05/04/2016, 22/04/201
#	Transaction Amo...	Transaction Amount		3,433, 2,554, 3,082
Abc	Department	Department		Groceries, Household Appliances, Ele
Abc	Cashier	Cashier		Sharpe, Tasha F., Cooke, Philip R., Gr
Abc	Store ZIP	Store ZIP		69993, 7584, 10105
Abc	Store City	Store City		Neerheylissem, Machilipatnam, Fort
Abc	Store Region	Store Region		South Africa, Mexico, Nauru
#	Revenue	Revenue		null
Abc	Table Names	Table Names		Sales_Data
Abc	File Paths	File Paths		April 2016 Sales.xlsx

Notice that there is a field named **Revenue** with null values. Throughout this course, we've used these sample files multiple times and the **Revenue** field name is unexpected, as is the null value. To investigate this further, add a clean step to your flow.

7. With **Clean 1** selected, scroll through the field list, to the **Revenue** field. The data profile shows a large number of null values, confirming our suspicion that there's something not right here. Select the **null** value in the profile chart. Doing so will highlight the origins of the **null** value in the **File Paths** field, which has automatically been added by Tableau Prep, as a result of the union. Here, we can clearly see that null values are present in all files, except the **November 2016 Sales.xlsx** file:



8. The only other numeric field in the dataset is **Transaction Amount**, so it is worth investigating that field as well. When you scroll over to the **Transaction Amount** field, you'll once again see a significant number of

null values. Repeat the process from the previous step, select the **null** value, and then observe the origins in the **File Paths** field.

This time, you can see that the origin is the opposite. All **null** values originate from the **November 2016 Sales.xlsx** file. And so we have determined that **Transaction Amount** and **Revenue** are likely to represent the same data, but the field labels have changed in the November file.

9. To resolve the problem we have identified, we need to merge the **Transaction Amount** and **Revenue** fields into a single field. To do so, select the **Transaction Amount** field, press the *Ctrl* key, and then select the **Revenue** field as well. With both fields selected, open the options menu on either field and then select **Merge**:

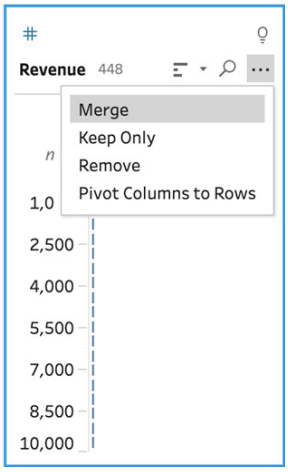
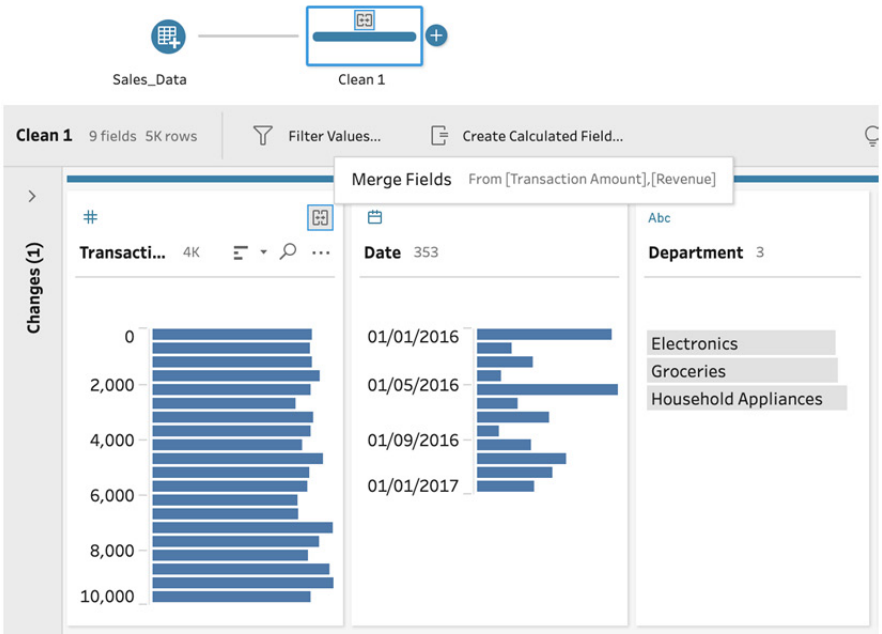


Tableau Prep will instantly merge the fields and assign it the name of the field first selected. An icon above that field will indicate the merge action. Hovering over the icon provides details on the fields that were merged:



With these steps completed, you have successfully performed a union during the input step.

How it works...

In this exercise, we've created a union as part of the input step, leveraged a filename and sheet matching pattern, toggled the matching style from include to exclude, and investigated a discrepancy as a result of a union of files with a different structure. As a result, we've learned how to ingest multiple files and perform a Union action using a single input step.

Combining datasets using an inner join

An inner join is the end result of joining two data sources together and retaining only those rows that overlap. For example, let's assume we have order data for a B2B seller of office supplies. Their data may be segmented into a database containing order information, and another database containing customer information. The overlap between these two sources is a common identifier, such as the customer's name, or, more likely, a unique customer ID.

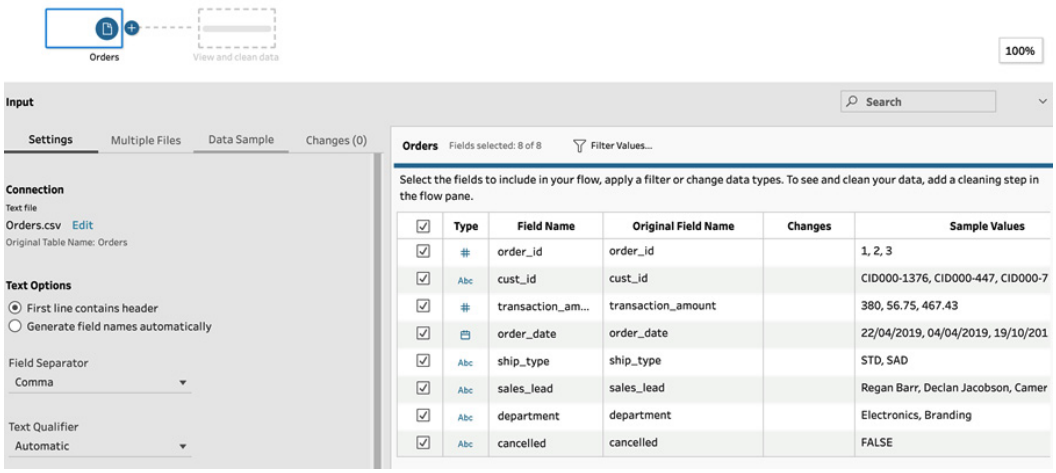
Getting ready

To follow along with this exercise, download the **Sample Files 5.3** folder from this course's GitHub repository.

How to do it...

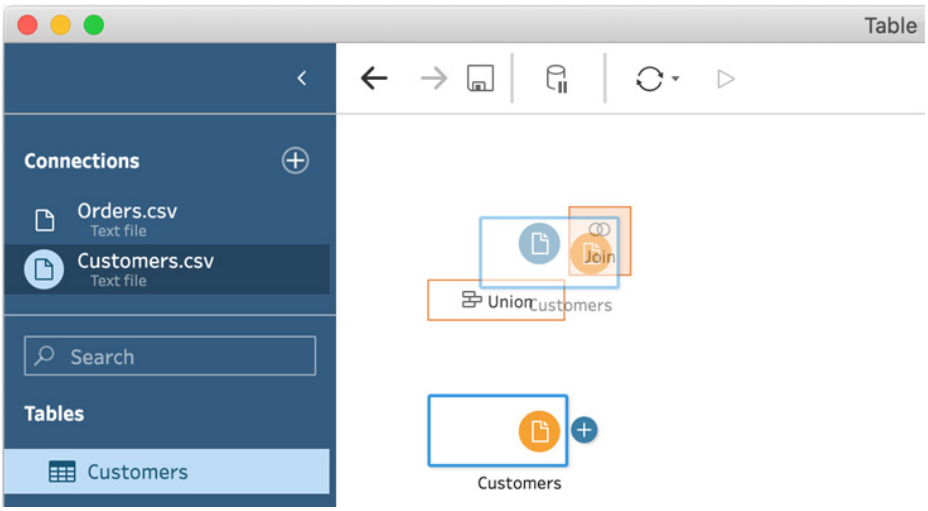
Start by opening Tableau Prep and perform the following steps to combine the two sample files using the **Inner Join** functionality:

1. Connect to the **Orders.csv** text file in order to create a brand-new flow with a data connection. The **Orders** file contains order data from a B2B supplier. Each row represents a separate order. Each customer is denoted by a unique identifier in the **cust_id** field:

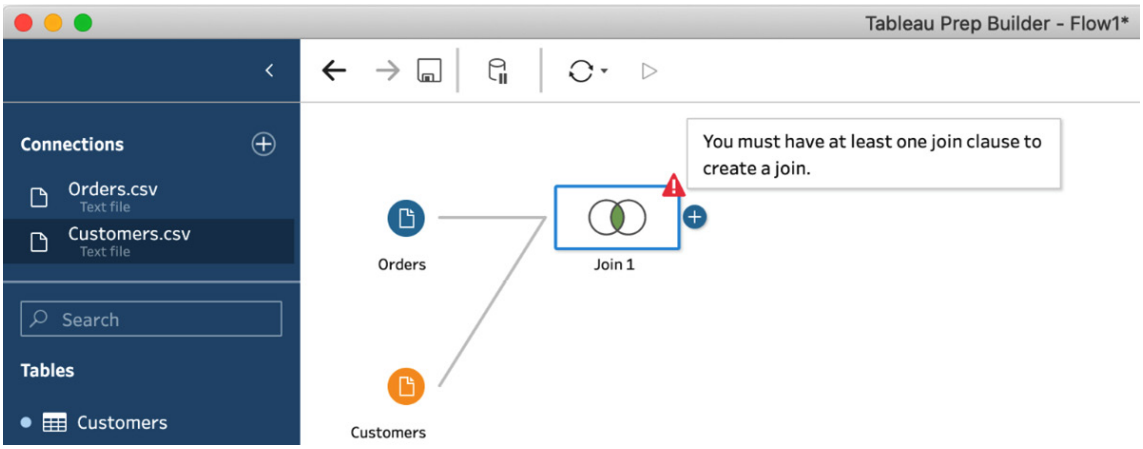


2. In our sample data folder, there is a separate file containing customer details, such as a customer contact name, email, and geographic information. In order to perform a comprehensive analysis on orders, for example, identifying the total sales by **State** or **County**, we need to combine these datasets. To get started, create a second connection in your flow to the **Customers.csv** file.

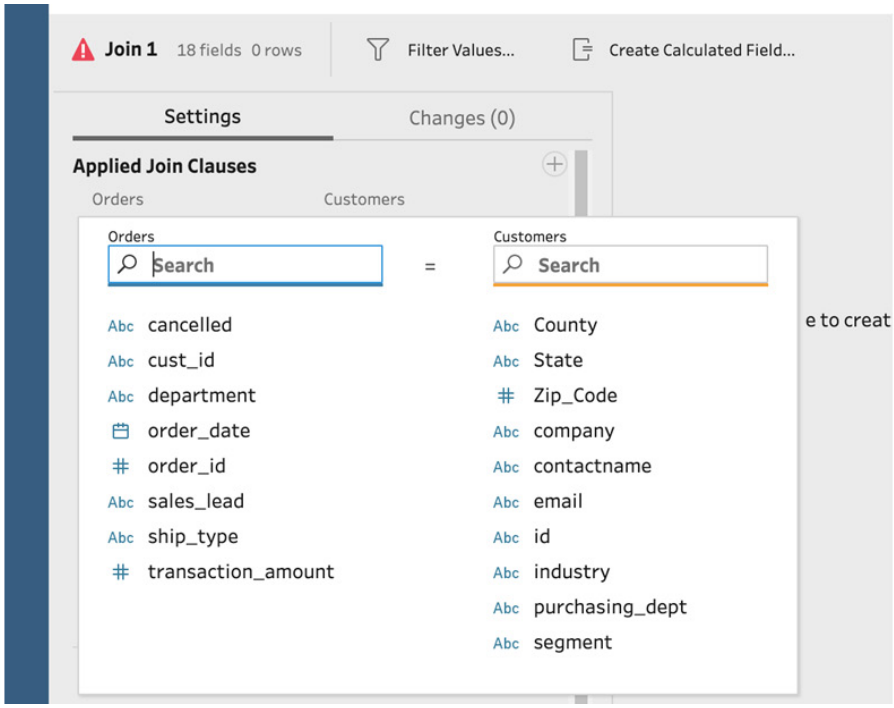
3. In order to start any new **join**, whether that is an inner join or any other type, we need to click and drag the second data connection step over the first step. When you hover on top of the first connection step, two options will appear, **Union** and **Join**. Ensure that **Join** is highlighted and then release your mouse hold:



A join will always require additional configuration before it is ready for use. Because Tableau Prep instantly evaluates the validity of your flow, creating a new join will initially result in a warning message. This is expected behavior and nothing to be concerned about:



4. Next, we need to specify how these two data sources can be connected, that is, which field, or combination of fields, they have in common. We can specify this in the bottom pane, in the **Applied Join Clauses** section. Here, click **Add** to reveal two field name lists. The field name lists indicate their source data connection, **Orders** and **Customers**, just above the search bar:

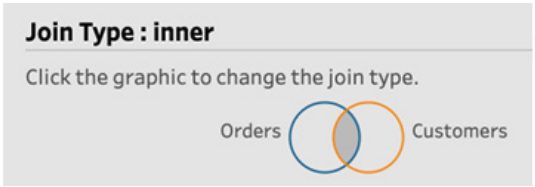


These data sources are connected by customer ID. In the **Orders** data source, this field is denoted by **cust_id**. In the **Customers** data source, it is denoted by **id**. Select these two fields to create your join clause.

Once a join clause has been created, as we did in the previous step, Tableau Prep will immediately execute the join and provide detailed results in the bottom pane. There are two specific areas to pay careful attention to when creating a join, **Join Type** and **Summary of Join Results**.

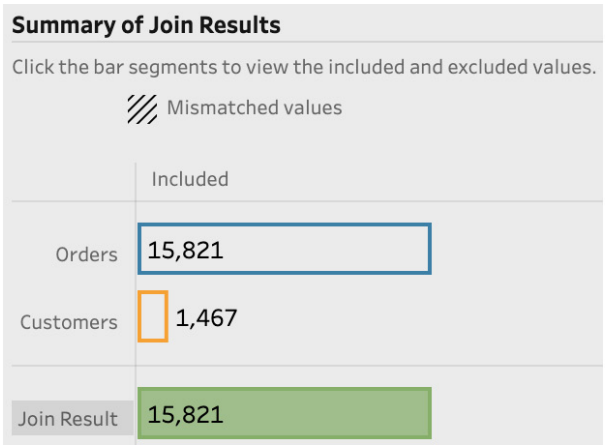
Join Type allows us to set the type of join, that is, an inner, left, right, full outer, or other type of join. By default, the type is set to **inner**, which is the type we require in this exercise, and so we do not have to alter it. An inner join will return all data that overlaps between the two data sources; in our case, all orders that have a customer associated with them.

In the following screenshot, we can see that the overlapping section of the two circles is selected, resulting in **Join Type : inner**:



Summary of Join Results provides valuable information regarding the outcome of a join operation. Specifically, it will inform us how many records are returned from each data source, after passing through the join, and how many records did not pass through because of a mismatch. In our example, a mismatch would occur if an order would *not* have a customer associated with it in the **Customers.csv** file. Our sample data has not mismatched and we're seeing a total of 15,821 rows from the **Orders** file passed through the join, as well as 1,467 rows from the **Customers** file. You can open both files in Excel to confirm that this is indeed the correct number of rows.

The following screenshot shows the join results of the steps we have just performed:



Let's move on to the next section!

How it works...

In this exercise, you've connected two data sources in a Tableau Prep flow. You then joined these two data sources using a common denominator, in this case, the customer ID. You've experienced how Tableau Prep immediately performs join operations without the need for you to run the entire flow. This is by design, and helps you validate your join prior to building out your flow further and possibly running into unexpected issues later on as a result of the output of the join step.

Combining datasets using a left or right join

In a left join, we pass through all the data from the first dataset, that is, the left data source, and only those records from the second, right data source that we were able to match. This means that any sales records that did not involve a loyalty card will still pass through, but the additional fields from the second source will simply be empty, or null.

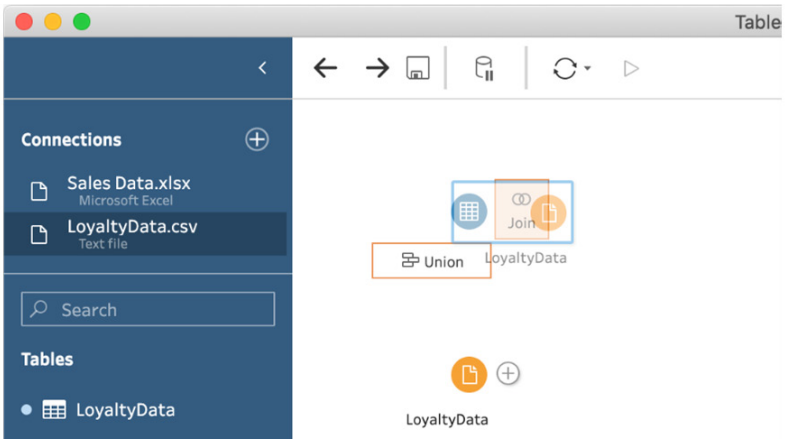
Getting ready

To follow along with this exercise, download the **Sample Files 5.4** folder from this course's GitHub repository.

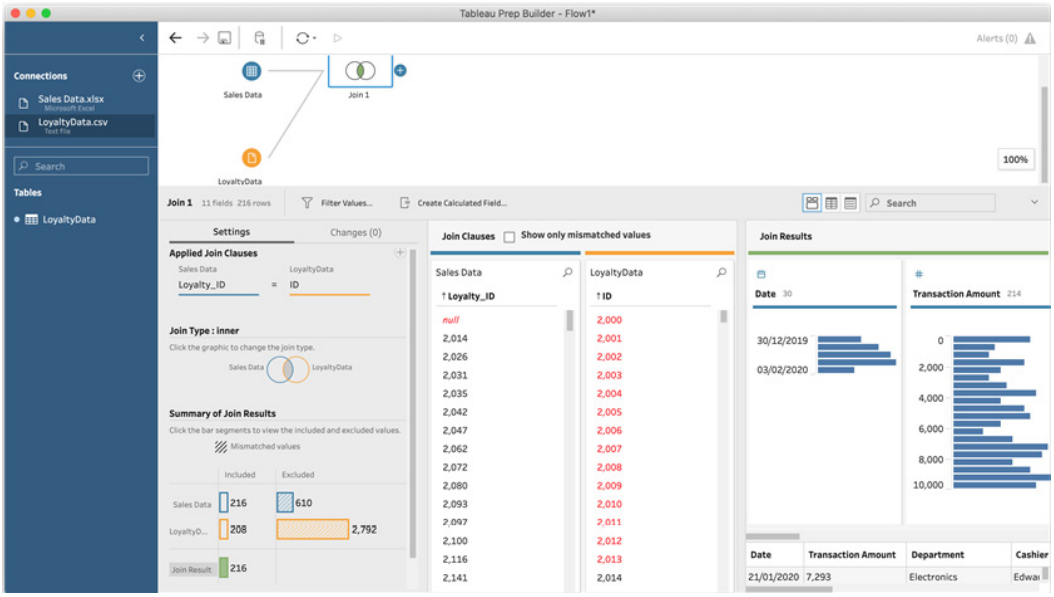
How to do it...

Start by opening Tableau Prep and perform the following steps to enrich the sample sales data with the customer loyalty card data, if available:

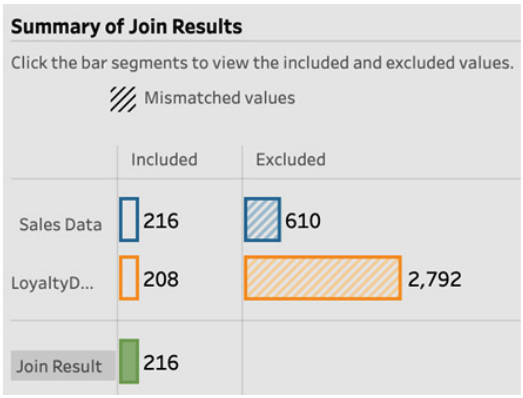
1. Connect to the **Sales Data.xlsx** Excel file in order to create a brand-new flow with a data connection. Let's assume this is sales data from a checkout system, where a customer may or may not have used a loyalty card. If the transaction involved a loyalty card, there will be a value in the **Loyalty_ID** field, otherwise it will be null.
2. Now, bring in the customer loyalty card data by creating a second data connection, this time to the **LoyaltyData.csv** text file.
3. Create a join by dragging the **LoyaltyData** data source on top of the **Sales Data** source, ensuring that you release when the join is highlighted:



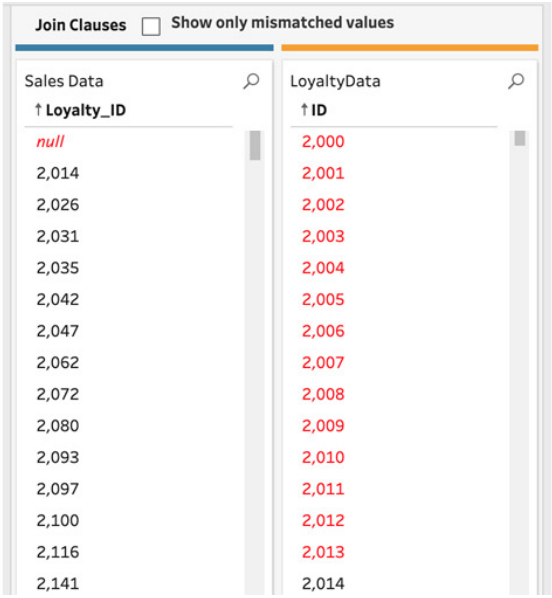
4. Set the join clause to use the **Loyalty_ID** field from the **Sales Data** source and the **ID** field from the **LoyaltyData** source. Once you apply the join clause, Tableau Prep will immediately perform the join operation and, after a few moments, provide you with the results, in both summary and detail, within the bottom pane:



Note that Tableau Prep indicates a number of mismatched values in the **Summary of Join Results** section. Because the default join type is an inner join, Tableau Prep will only return rows that have a common identifier in both sources, in this case, our loyalty ID. Any other rows are excluded. The join result gives the count of rows that actually passed through the join, 216 in this case, out of a total of 826 sales transactions:



The middle section in the join step settings shows all the IDs that could not be matched in a red font. For example, **null** from **Sales Data** could not be matched to any row in the **LoyaltyData** file and, as a result, is excluded from the join results. Similarly, the ID **2000** from the **LoyaltyData** file was not present in the sales data, and therefore is also excluded from the join results:



5. In our case, we want to return all our sales data rows and simply augment them with loyalty card data, if the customer used a loyalty card. Therefore, we need to change our join type to **Left Join**, meaning that we want to retrieve all data from the left side, **Sales Data**, and only those rows from the right side, **LoyaltyData**, when there is an overlap, based on **Loyalty ID**. To change the join type, select the left circle in the **Join Type** Venn diagram:

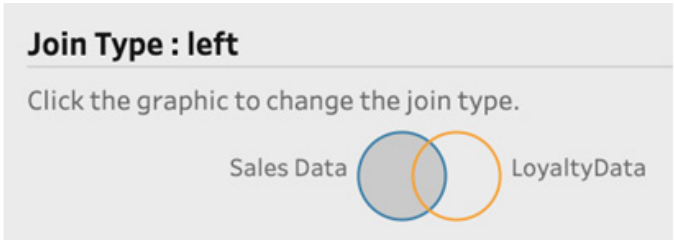
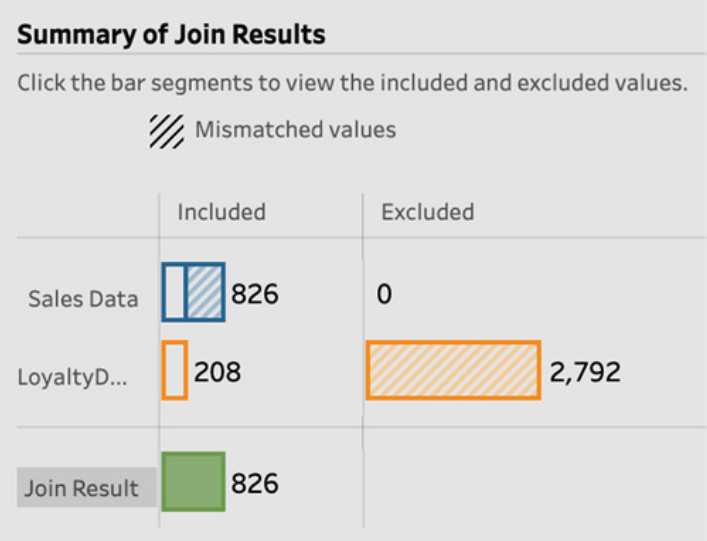
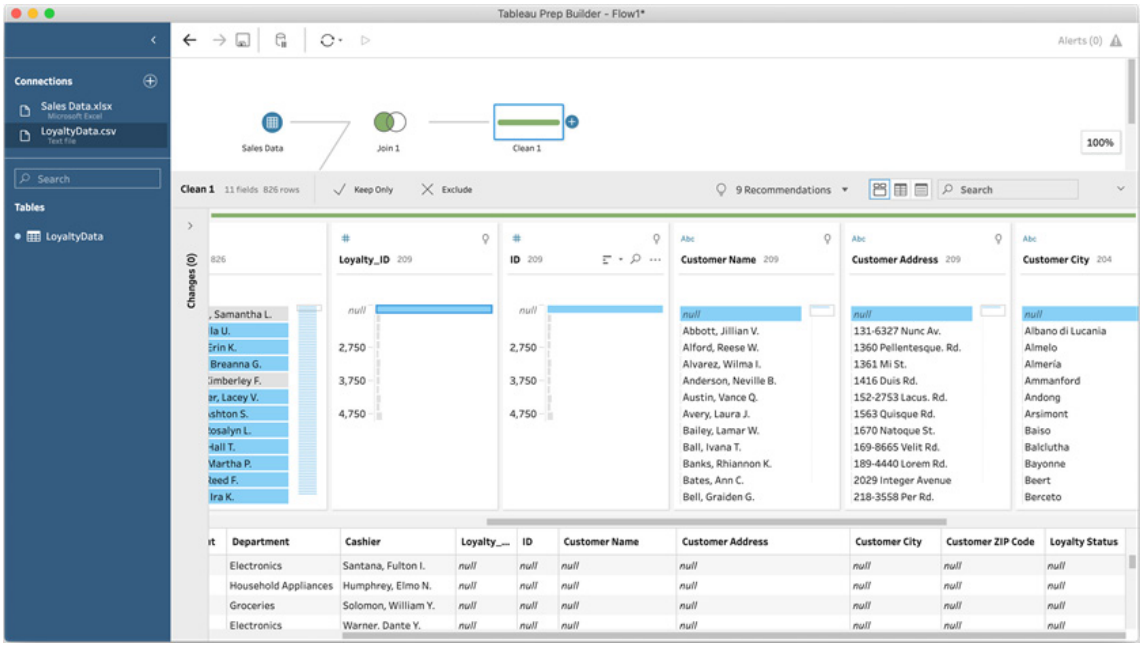


Tableau Prep immediately updates the join results, and, at a glance, we can now see from the summary that all 826 **Sales Data** rows are being passed through:



You may review the row-by-row results in a more organized pane by adding a clean step to your flow and selecting **null** from the **Loyalty_ID** field. This will display all rows where a transaction was made without a loyalty card, and you can see that the values for customer information are set to **null** as a result:



With these steps completed, you've successfully utilized Tableau Prep to perform a left join.

How it works...

In this exercise, you've created a left join, which resulted in returning all rows from one data source, and only those rows from a complementary data source when there was a common identifier. A right join would have performed the

exact opposite, that is, returned all rows from the second data source, and only matching rows from the first data source.

There are many use cases for a left or right join, as in many scenarios we combine data from multiple sources to a core data source, such as transactions or customers.

Expanding datasets using a full outer join

In the *Combining data ingest and Union actions* exercise, we created an inner join to return rows from two data sources that had a commonality. In the *Combining datasets using a left or right join* exercise, we created a left join to return all rows from a data source and enrich that data with information from a second source, whenever there was additional information available, without dropping any rows from the original source.

In this exercise, we'll look at a variation of the join, which is named the **full outer join**. In this case, we'll want to retrieve all rows from both data sources involved in the join, that is, even if there's no overlap. It's essentially doing a left and right join at the same time; you won't lose any data from either data source.

In the example that follows, we'll use a use case where a company is running several projects and each project may have a number of people assigned to it. However, some projects may not have started yet, or may have already been completed. Those inactive projects won't have people assigned to them. Similarly, people may be assigned to a project, or are currently between projects and not assigned directly to any project. We want the result of our join to return all projects and all people.

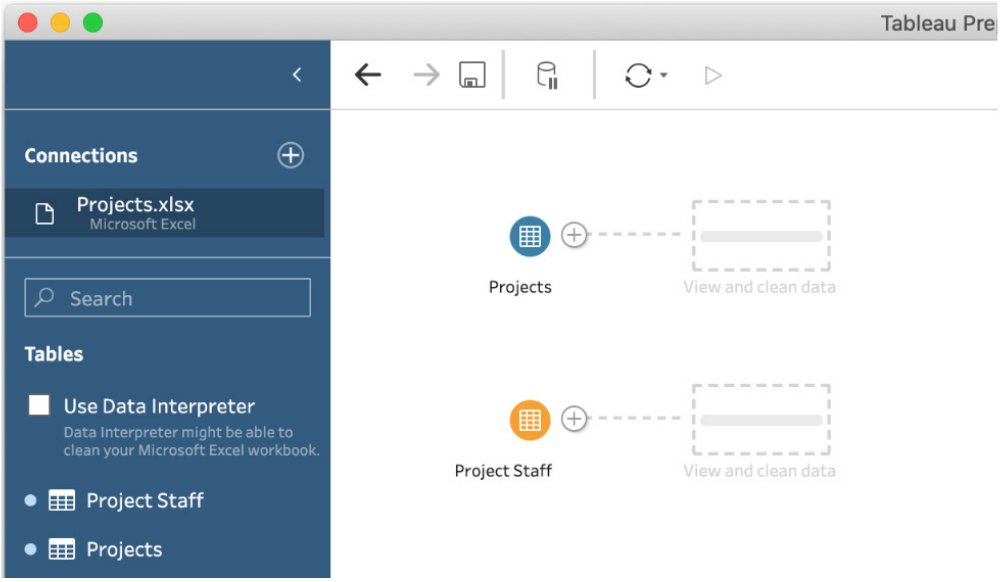
Getting ready

To follow along with this exercise, download the **Sample Files 5.5** folder from this course's GitHub repository.

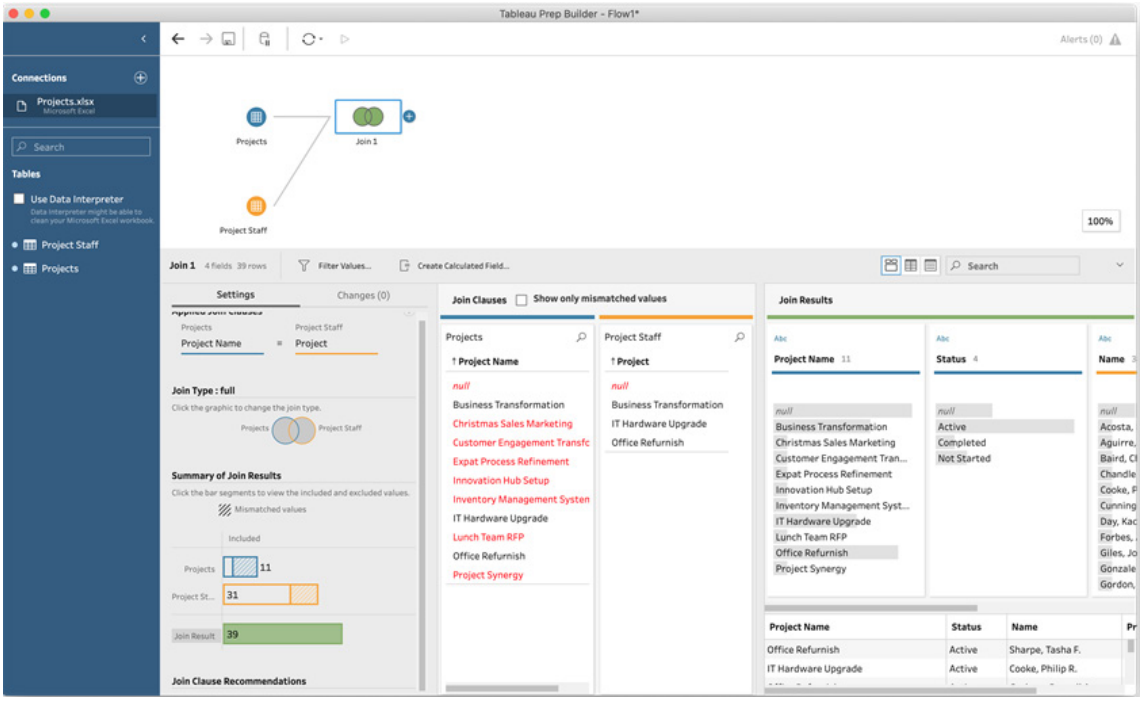
How to do it...

Start by opening Tableau Prep and perform the following steps to create a full outer join to combine project and people data:

1. Connect to the **Projects.xlsx** Excel file in order to create a brand-new flow with a data connection. From the available tables, drag the **Projects** table onto the canvas.
2. The source we've connected to contains two tables, **Projects** and **Project Staff**. Without creating a brand-new data connection, drag the **Project Staff** table onto the canvas to create a second input, using the same data connection:



3. To initiate the join creation process, drag the **Project Staff** input on top of **Projects**, releasing it when the join icon is highlighted.
4. Create a join clause using the **Project Name** field for the **Projects** input, and the **Project** field for the **Project Staff** input.
5. To complete the configuration, click the left circle in the Venn diagram, followed by the right circle. This will then update the join to become a full outer join. Notice that the type name is abbreviated to simply state **full**:



With these steps completed, you've successfully performed a full outer join with Tableau Prep.

How it works...

In this exercise, you've leveraged a full outer join to combine two data sources, even if those sources have nothing in common. In this case, we have included projects that were not assigned any staff and included staff that were not assigned to any project.

Using a full outer join can come in handy for specific scenarios. However, there is a risk of creating a dataset that is incorrect since, with a full outer join, you may expect many mismatched values, and a mistake is easily made by ignoring the mismatches. It is prudent to double-check that your join clause is correct with any join, but perhaps even more so with a full join, for this reason.

Expanding datasets using a not inner join

In this lab, we have assumed in all join-related exercises that there was an overlap between two data sources. However, for analysis purposes, you may be interested in what data is not overlapping, so that you can take action appropriately.

Using the same data as we've used in the *Expanding datasets using a full outer join* exercise, where we have a data source with projects, and another data source with project staff, we may change our use case to focus solely on data that does not overlap. That is, we are only interested in projects without staff assigned to them, or staff members not currently assigned to work on any project.

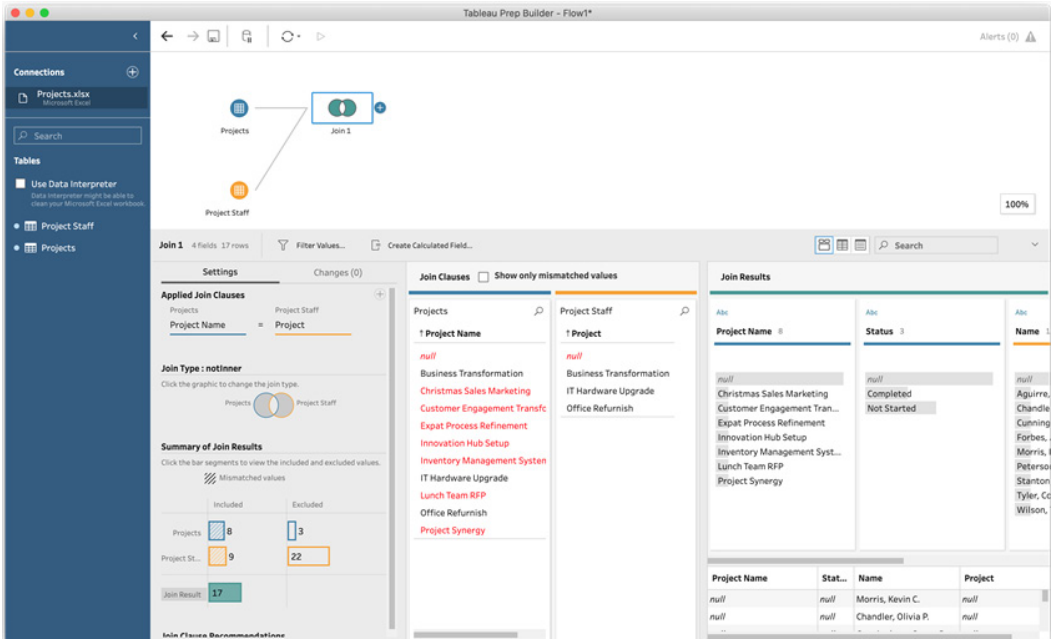
Getting ready

To follow along with this exercise, download the **Sample Files 5.6** folder from this course's GitHub repository.

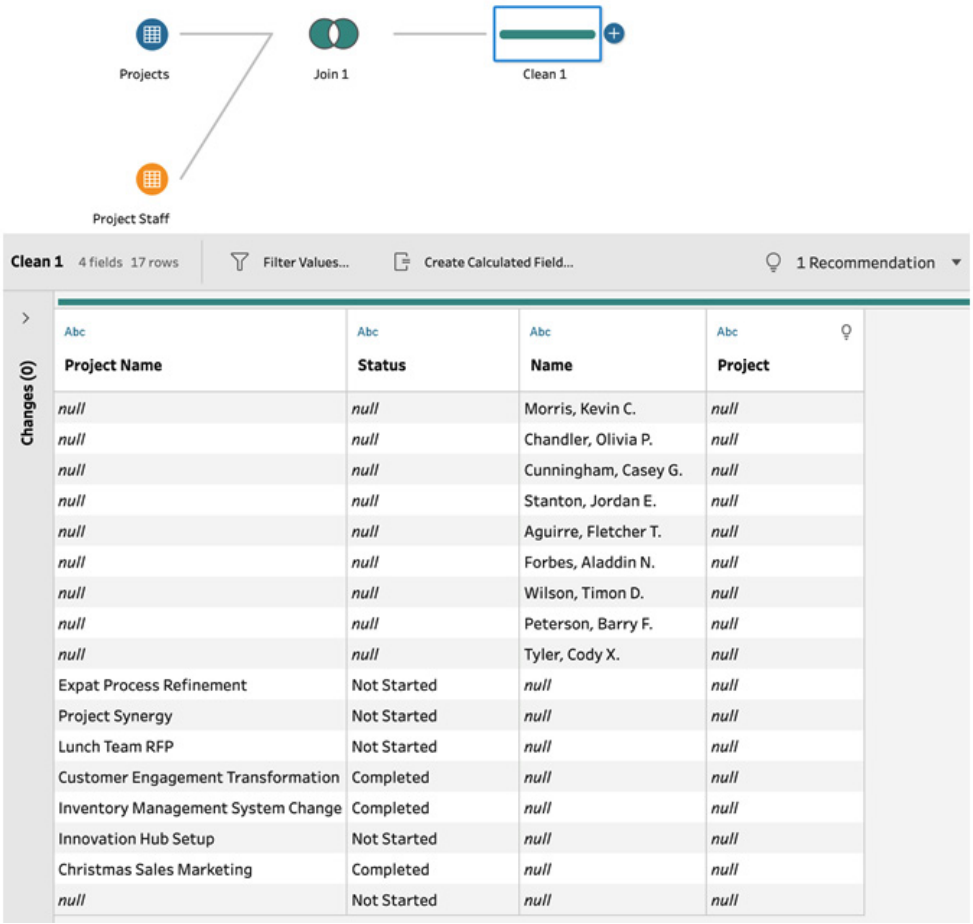
How to do it...

Start by opening Tableau Prep and perform the following steps to create a **not inner join**:

1. Connect to the **Projects.xlsx** Excel file in order to create a brand-new flow with a data connection. From the available tables, drag **Projects** onto the canvas.
2. From the same list of tables, drag **Project Staff** onto the canvas to create a second input step.
3. Drag the **Project Staff** step on top of **Projects**, releasing when the join icon is highlighted, in order to create a new join.
4. Configure **Join Clause** to match the data on **Project Name** from the **Projects** source, and **Project** from the **Project Staff** source.
5. To create the **not inner join**, click the Venn diagram in the following order. First, click the left circle, then the right circle, and finally the center where both circles overlap. When done, the join type will state **notInner**:



6. Add a clean step to your flow, after the join, to view the data in the preview section. Here, you can clearly see that you have included only projects without staff and staff without projects:



Abc Project Name	Abc Status	Abc Name	Abc Project
null	*null*	Morris, Kevin C.	*null*
null	*null*	Chandler, Olivia P.	*null*
null	*null*	Cunningham, Casey G.	*null*
null	*null*	Stanton, Jordan E.	*null*
null	*null*	Aguirre, Fletcher T.	*null*
null	*null*	Forbes, Aladdin N.	*null*
null	*null*	Wilson, Timon D.	*null*
null	*null*	Peterson, Barry F.	*null*
null	*null*	Tyler, Cody X.	*null*
Expat Process Refinement	Not Started	*null*	*null*
Project Synergy	Not Started	*null*	*null*
Lunch Team RFP	Not Started	*null*	*null*
Customer Engagement Transformation	Completed	*null*	*null*
Inventory Management System Change	Completed	*null*	*null*
Innovation Hub Setup	Not Started	*null*	*null*
Christmas Sales Marketing	Completed	*null*	*null*
null	Not Started	*null*	*null*

With this step completed, you've performed the **Not Inner Join** method of discarding data.

How it works...

A not inner join works by discarding the data which would be put through as the result of an inner join. In doing so, Tableau Prep allows you to quickly identify rows that cannot be matched across the data sources used. This can be helpful in scenarios such as the one used in this exercise, or even for identifying data quality issues where you expect a match, but the data is not providing a match on every row.