



## **DATA VISUALIZATION LAB (C84PC7)**

**CSE (DATA SCIENCE)**

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**B.Tech II Semester**

**L/T/P/C  
0 /0/ 2/ 1**

### **Course Objectives:**

To obtain practical experience using Tableau public or similar tools.

### **Course Outcomes:**

After completion of the lab student will be able to:

Visualize the different types of data.

# DV LAB



### List of Sample Problems:

1. Tableau/ Power BI or similar tools setup for Data Visualization (Importing packages etc....).
2. Extracting and operations of data from different sources.
3. Working on worksheets.
4. Applying the Calculations (Operators, Functions, Numerical Calculations, String, Date, Table).
5. Usage of Different types of Filter & Sort.
6. Construction of Charts (Line, BAR, etc.).
7. Creation of Dashboard (Optional).

# DV LAB



## **PROGRAM 1:**

### **AIM: Introduction to tableau**

Tableau is a Business Intelligence tool for visually analyzing the data. Users can create and distribute an interactive and shareable dashboard, which depict the trends, variations, and density of the data in the form of graphs and charts

Download Tableau Desktop

**Step 1)** Go to <https://public.tableau.com/en-us/s/download> on your web browser. Now you need to enter your email id and click on “**DOWNLOAD THE APP**” button.

public.tableau.com/en-us/s/download

+tableau+public

GALLERY AUTHORS BLOG

You'll be exploring in minute

Enter your email address DOWNLOAD THE APP

2019.2 Available for Windows and Mac (OS X) | System Requirements

**Step 2)** This will start downloading the .exe file for Windows by default, and you can see the downloading process in the bottom left corner of the website.

TableauPublicDesk....exe  
18.8/338 MB, 3 mins left

State/Province Borders  
Province Names  
Water Labels  
Cities  
Points of Interest  
Neighborhoods  
Subway and Train Stations  
Building Footprints  
House Numbers

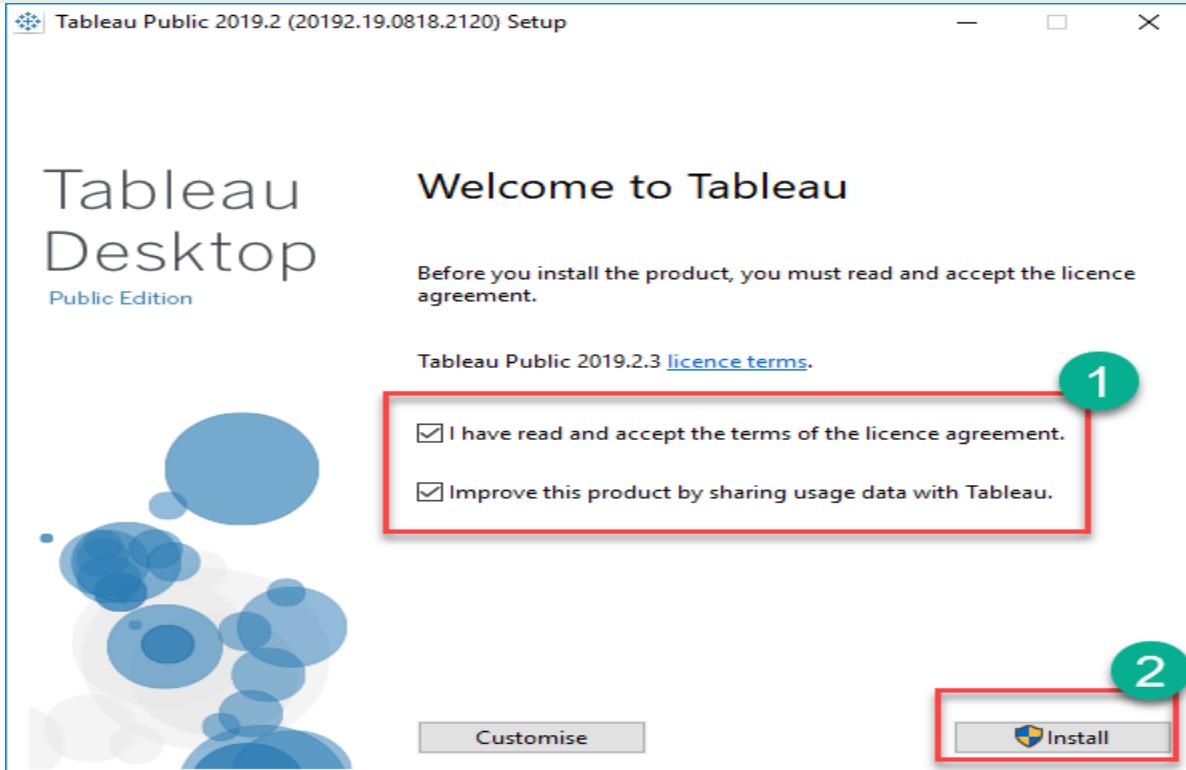
Data Layer  
Layer: No Data Layer

**Step 3)** Open the downloaded file. Accept the terms and conditions and click on “Install” button.

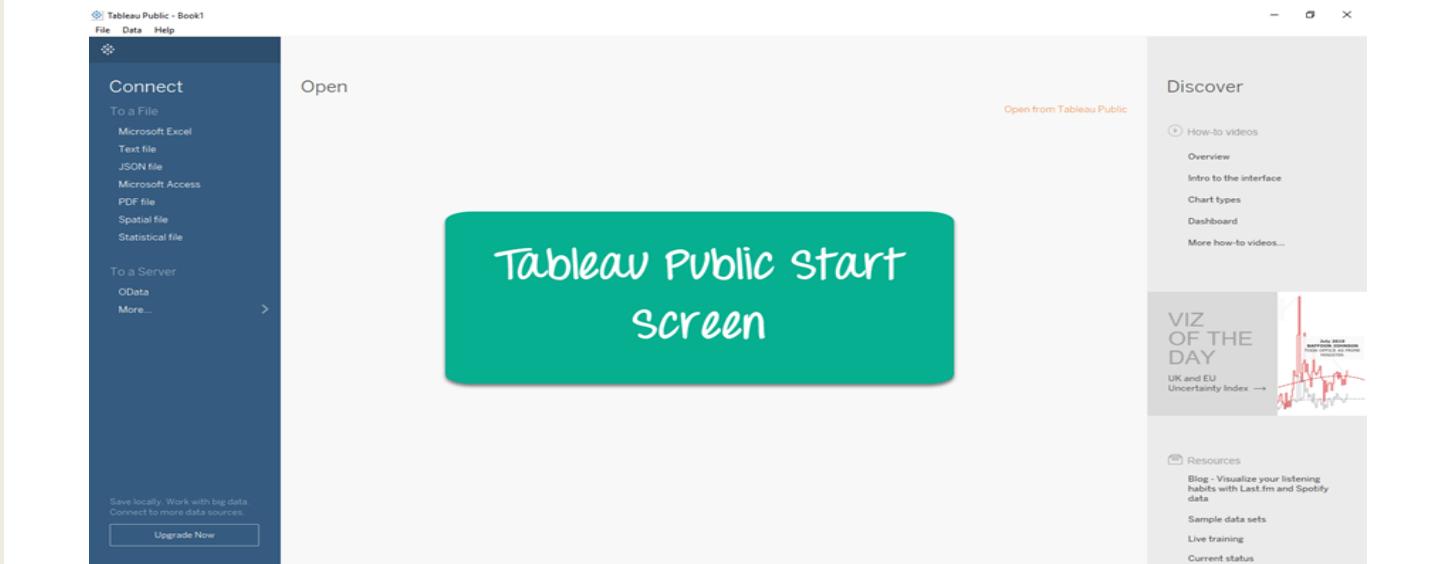


## TKR COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)

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**Step 4)** After installation Start Screen of Tableau is shown

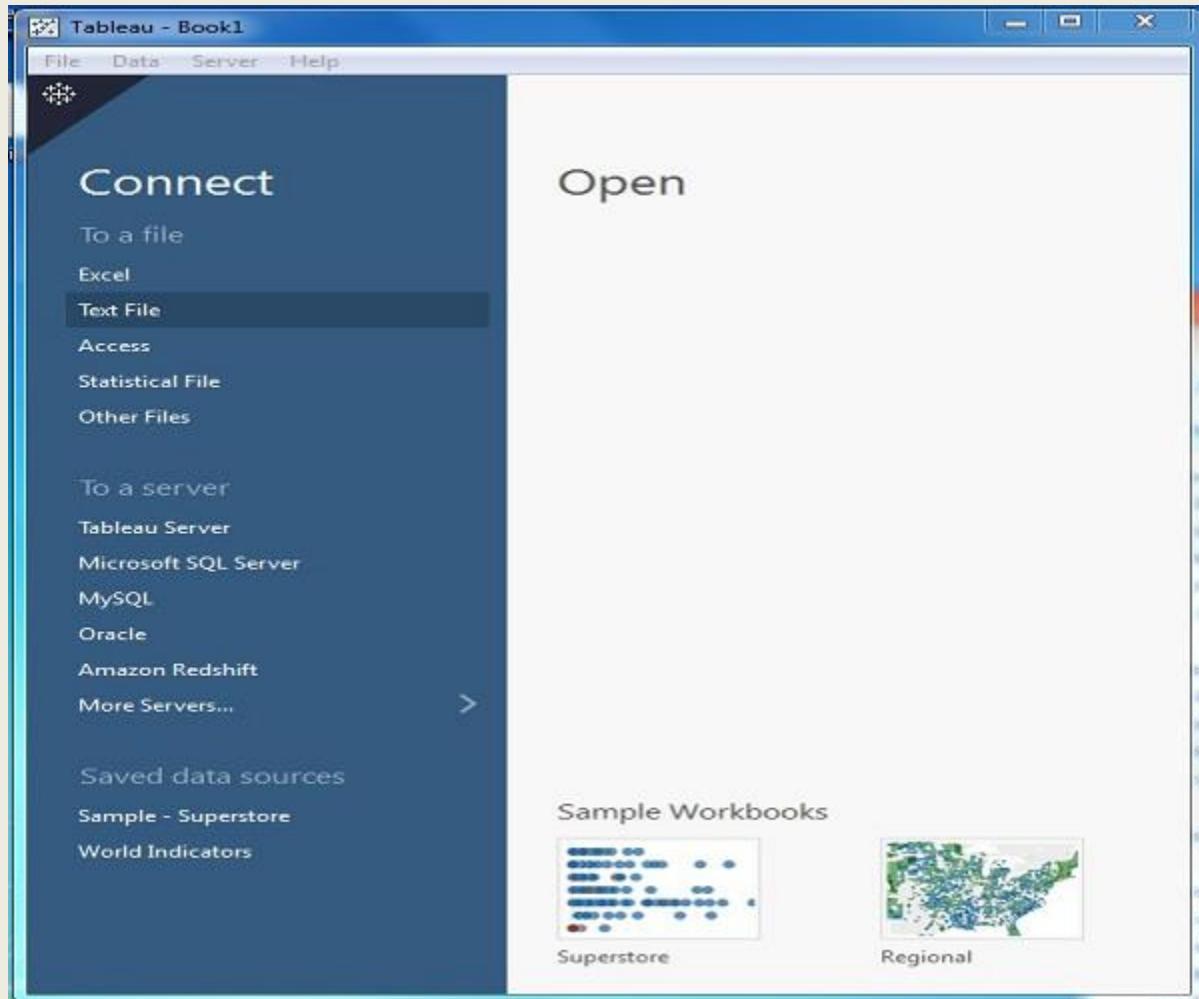


You can verify the installation by going to the Windows start menu. Click the Tableau icon. The following screen appears.



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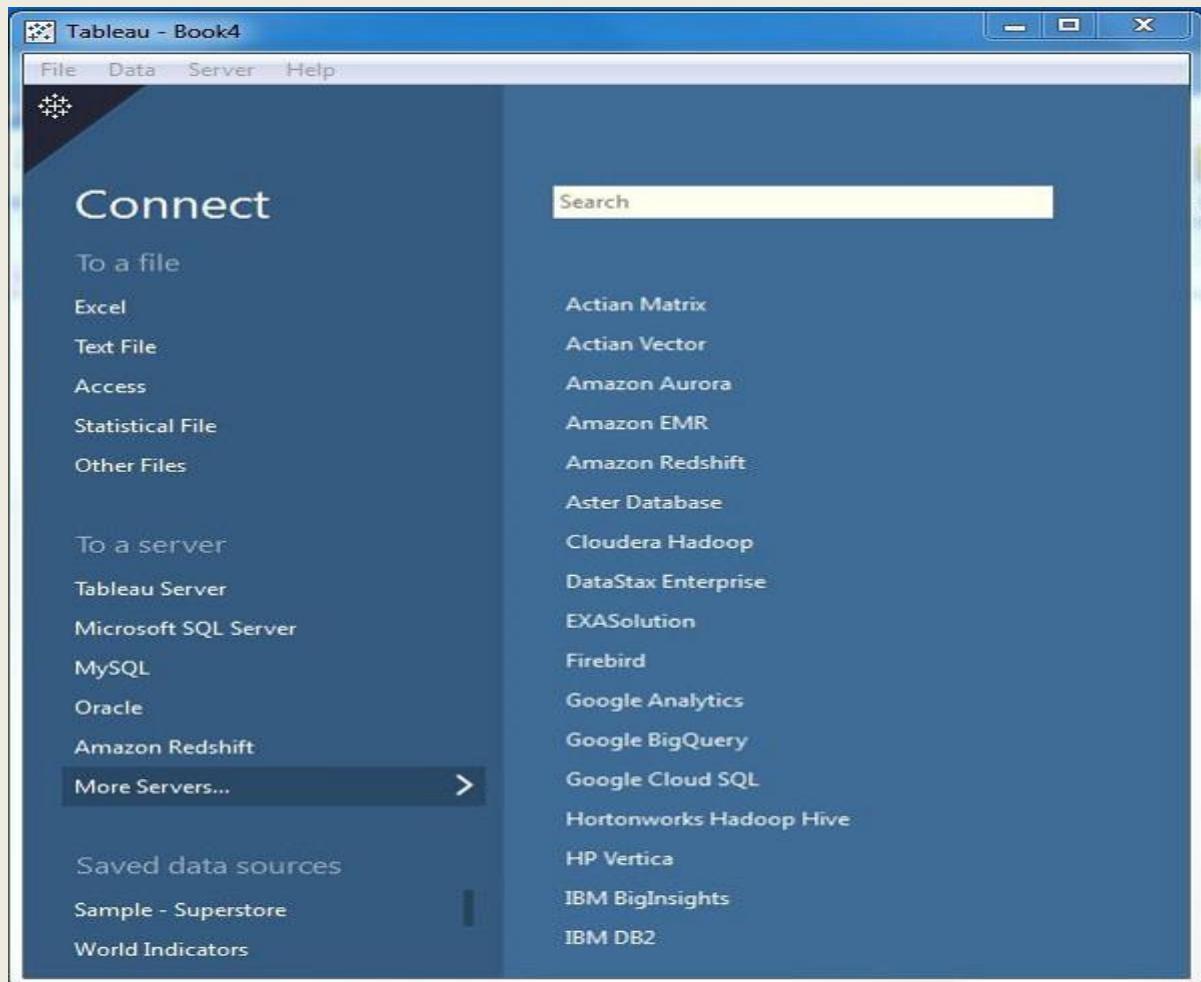
## **PROGRAM 2:**

**AIM : Extracting and operations of data from different sources.**

Tableau can connect to all the popular data sources which are widely used. Tableau's native connectors can connect to the following types of data sources.

- **File Systems** such as CSV, Excel, etc.
- **Relational Systems** such as Oracle, Sql Server, DB2, etc.
- **Cloud Systems** such as Windows Azure, Google BigQuery, etc.
- **Other Sources** using ODBC.

The following picture shows most of the data sources available through Tableau's native data connectors





## Connect Live

The Connect Live feature is used for real-time data analysis. In this case, Tableau connects to real-time data source and keeps reading the data. Thus, the result of the analysis is up to the second, and the latest changes are reflected in the result. However, on the downside, it burdens the source system as it has to keep sending the data to Tableau.

## In-Memory

Tableau can also process data in-memory by caching them in memory and not being connected to the source anymore while analyzing the data. Of course, there will be a limit to the amount of data cached depending on the availability of memory.

## Combine Data Sources

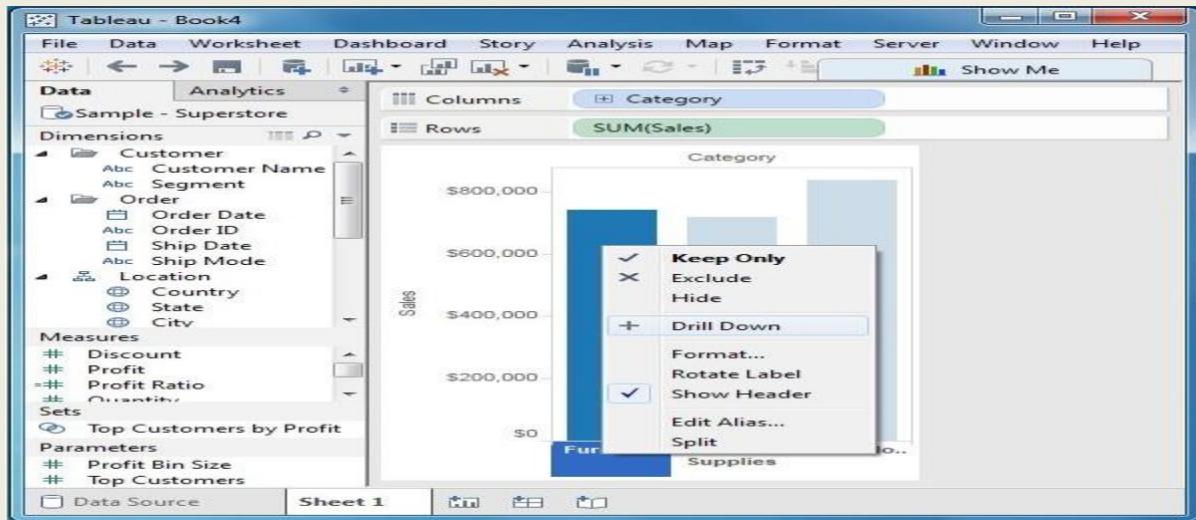
Tableau can connect to different data sources at the same time. For example, in a single workbook you can connect to a flat file and a relational source by defining multiple connections. This is used in data blending, which is a very unique feature in Tableau.

A custom data view is used to extend the normal data views with some additional features so that the view can give different types of charts for the same underlying data. For example, you can drill down a dimension field which is part of a pre-defined hierarchy so that additional values of the measures are obtained at a different granularity. Following are some of the frequently used and important custom data views Tableau offers.

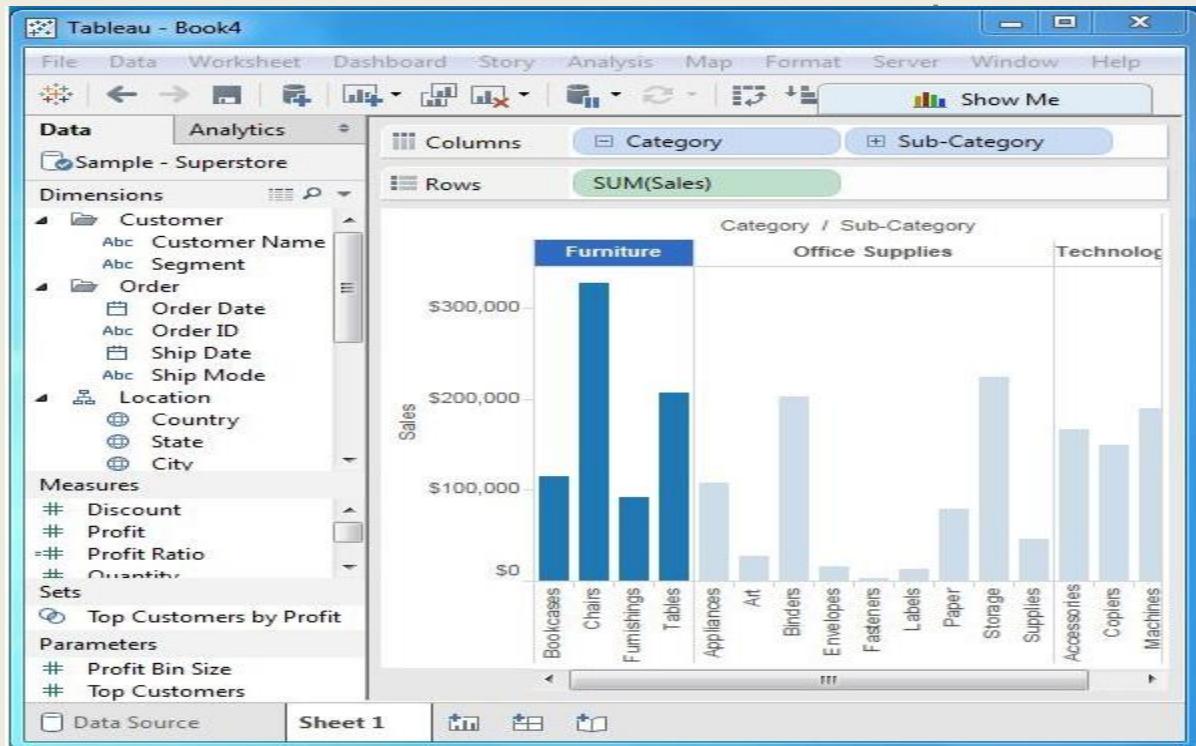
## Drill Down View

For dimension fields which are part of a hierarchy, you usually need to know the result of analysis for the next or previous level of aggregation. For example, when you know the result for a quarter, you get interested to know the results for each month in that quarter, and you may even need the result for each week. This is a case of drilling down the existing dimensions to get a finer level of granularity.

To drill down and drill up for individual dimension members in a hierarchy, right-click a table header and select Drill Down from the context menu. Consider a bar chart created with the dimension category in the columns shelf and the measure Sales in the Rows shelf. Right-click on the bar representing Furniture and select Drill Down.



The result of the drill down action is shown in the following screenshot.





## Swapping Dimensions

we can create a new view from an existing view by swapping the position of the dimensions. This does not change the values of the measures, but it does change the position of the measures. Consider a view for analyzing the Profit for each year for each segment and category of products. You can click on the vertical line at the end of category column and drag it to the segment column. This action is shown in the following screenshot.

The screenshot shows a Tableau worksheet titled "Book4". The top menu bar includes File, Data, Worksheet, Dashboard, Story, Analysis, Map, Format, Server, Window, and Help. The toolbar below has various icons for data sources, filters, and analysis. The left sidebar shows "Columns" with "YEAR(Order Date)" selected and "Rows" with "Segment" and "Category" both selected. The "Marks" section on the left has "Abc Automatic" selected, with options for Color, Size, Text, Detail, Tooltip, and SUM(Profit). The main canvas displays a data table with columns for Segment, Category, and years 2011, 2012, 2013, and 2014. The rows are grouped by Segment (Consumer, Corporate, Home Office) and Category (Furniture, Office Supplies, Technology). The data is as follows:

Segment	Category	Order Date			
		2011	2012	2013	2014
Consumer	Furniture	\$1,636	-\$1,322	\$4,605	\$2,072
	Office Supplies	\$9,595	\$12,793	\$16,360	\$17,583
	Technology	\$13,090	\$16,990	\$14,793	\$25,925
Corporate	Furniture	\$361	\$2,966	\$3,170	\$1,088
	Office Supplies	\$9,018	\$6,564	\$8,682	\$15,963
	Technology	\$4,134	\$11,158	\$19,088	\$9,787
Home Office	Furniture	\$3,461	\$1,371	-\$815	-\$142
	Office Supplies	\$3,981	\$5,743	\$9,974	\$6,236
	Technology	\$4,269	\$5,357	\$5,870	\$14,995

The result of the swapping of the two dimensions is shown in the following screenshot. As you can see, only the position of the values of the measure Profit changes for each category and segment, and not its value.



The screenshot shows the Tableau interface with a data extract configuration. The top menu bar includes File, Data, Worksheet, Dashboard, Story, Analysis, Map, Format, Server, Window, and Help. The toolbar below has various icons for navigation and analysis. The left sidebar shows 'Columns' and 'YEAR(Order Date)' selected under 'Marks'. The main workspace displays a data extract preview with a table titled 'Order Date' containing four columns: Category, Segment, 2011, 2012, 2013, and 2014. The table data is as follows:

Category	Segment	2011	2012	2013	2014
Furniture	Consumer	\$1,636	-\$1,322	\$4,605	\$2,072
	Corporate	\$361	\$2,966	\$3,170	\$1,088
	Home Office	\$3,461	\$1,371	-\$815	-\$142
Office Supplies	Consumer	\$9,595	\$12,793	\$16,360	\$17,583
	Corporate	\$9,018	\$6,564	\$8,682	\$15,963
	Home Office	\$3,981	\$5,743	\$9,974	\$6,236
Technology	Consumer	\$13,090	\$16,990	\$14,793	\$25,925
	Corporate	\$4,134	\$11,158	\$19,088	\$9,787
	Home Office	\$4,269	\$5,357	\$5,870	\$14,995

At the bottom of the workspace, there are tabs for 'Data Source' and 'Sheet 1', along with other interface elements.

Data extraction in Tableau creates a subset of data from the data source. This is useful in increasing the performance by applying filters. It also helps in applying some features of Tableau to data which may not be available in the data source like finding the distinct values in the data. However, the data extract feature is most frequently used for creating an extract to be stored in the local drive for offline access by Tableau.

### **Creating an Extract:**

Extraction of data is done by following the menu - Data → Extract Data. It creates many options such as applying limits to how many rows to be extracted and whether to aggregate data for dimensions. The following screen shows the Extract Data option.



The screenshot shows the Tableau application interface. The 'Data' pane on the left is expanded, showing various data sources and their structures. A context menu is open over the 'Sample Superstore' data source, specifically under the 'Extract Data...' option. The menu includes options like 'Use Extract', 'Extract', 'Edit Data Source Filters...', 'Replace Data Source...', 'Assume Referential Integrity', 'Date Properties...', 'Edit Aliases...', 'Publish to Server...', 'Add to Saved Data Sources...', and 'Properties...'. The 'Rows' and 'Columns' panes on the right are also visible.

## Applying Extract Filters:

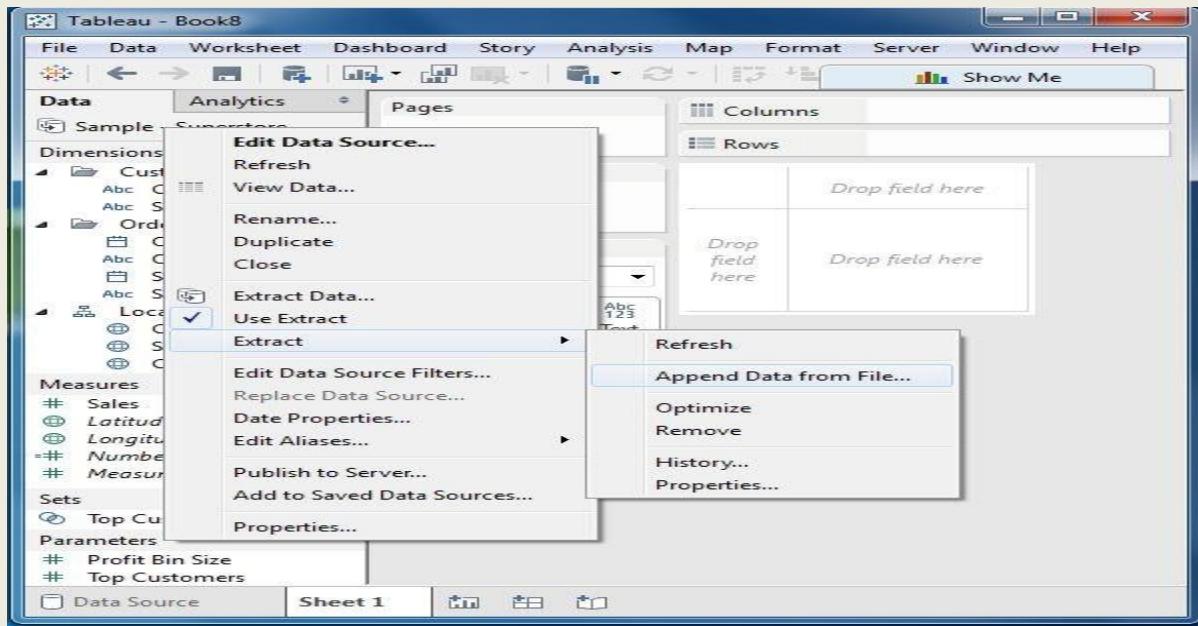
To extract a subset of data from the data source, you can create filters which will return only the relevant rows. Let's consider the Sample Superstore data set and create an extract. In the filter option, choose Select from list and tick mark the checkbox value for which you need to pull the data from the source.

The screenshot shows the 'Extract Data' dialog box for the 'Sample Superstore' data source. The 'Filters' tab is selected. A 'Filter [Sub-Category]' dialog is open, showing a list of categories with checkboxes. Several categories like 'Accessories', 'Appliances', 'Art', 'Binders', 'Bookcases', 'Chairs', 'Copiers', 'Envelopes', 'Fasteners', 'Furnishings', and 'Labels' have checkboxes checked. Below the list are buttons for 'All', 'None', and 'Exclude'. At the bottom, there is a summary section with fields: Field: [Sub-Category], Selection: Selected 5 of 17 values, Wildcard: All, Condition: None, and Limit: None. There are 'Reset', 'OK', and 'Cancel' buttons at the bottom right.

## Adding New Data to Extract:



To add more data for an already created extract, you can choose the option Data → Extract → Append Data from File. In this case, browse the file containing the data and click OK to finish. Of course, the number and datatype of columns in the file should be in sync with the existing data.



### Extract History:

we can verify the history of data extracts to be sure about how many times the extract has happened and at what times.

For this, we can use the menu - Data → Extract History.

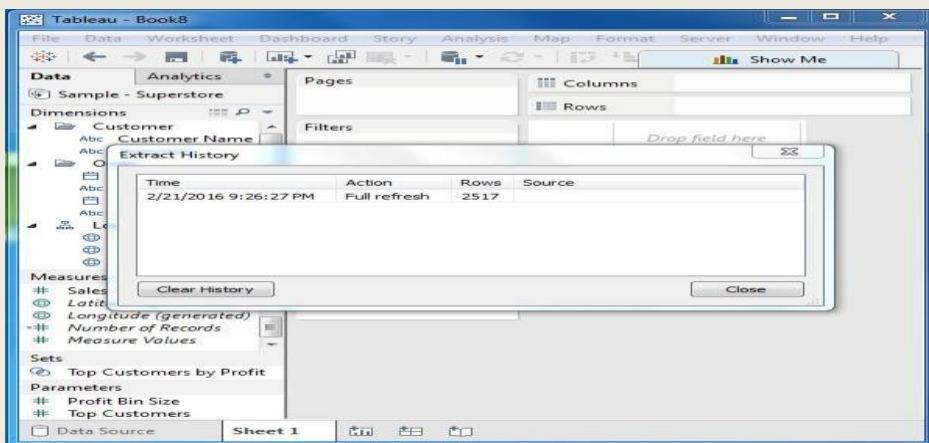


Tableau has many features to manipulate the fields present in Tableau data pane. You can rename the fields or combine two fields to create one field. Such operations help in better

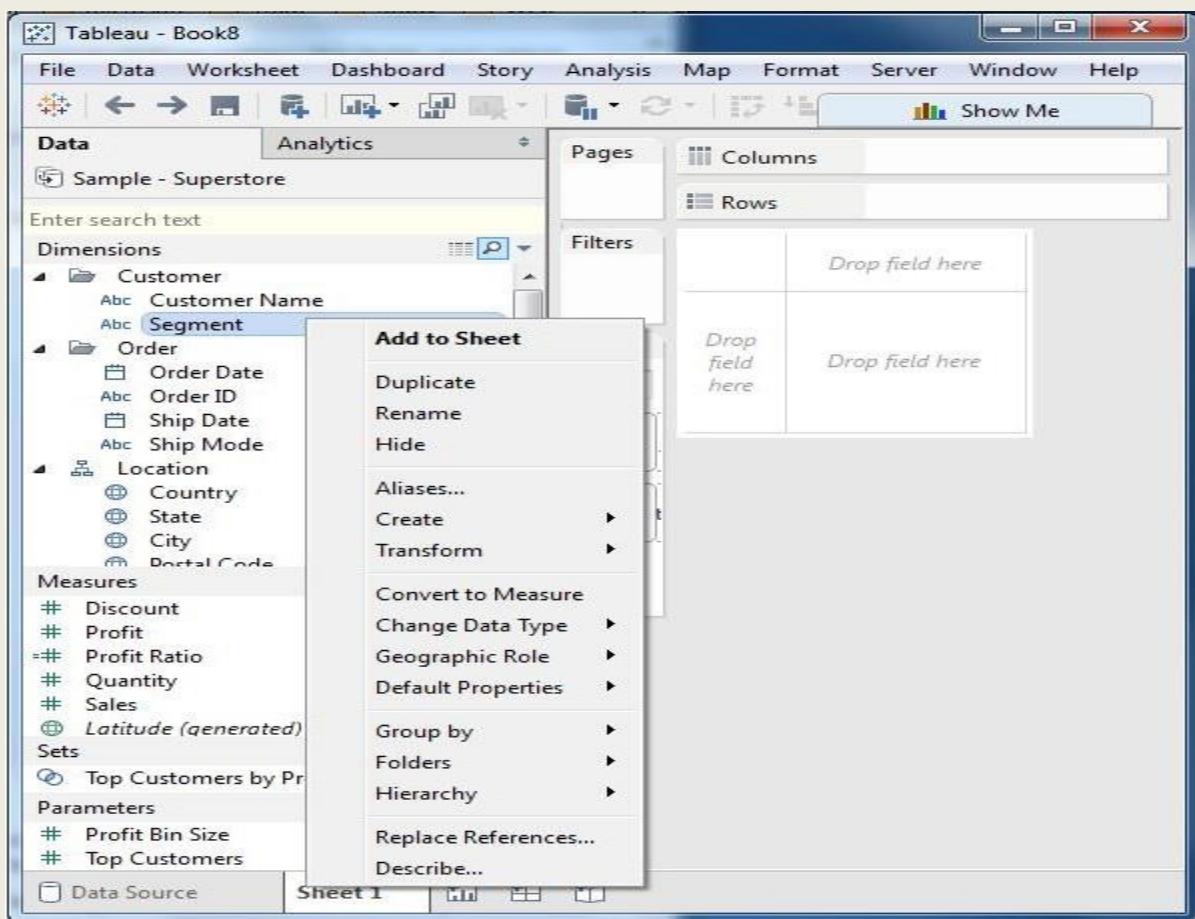


organization of the dimensions and measures, as well as accommodate two or more fields with the same name for better data analysis.

Following are the important examples of such Field Operations.

### **Adding Fields to Worksheet:**

You can add any field to the worksheet by right-clicking and choosing the option Add to Sheet. You can also drag and drop the fields into different shelves present in the worksheet, like Columns shelf, Rows shelf, Filters shelf, and many other shelves under the Marks card. The following diagram shows the right-click option.



### **Combining Two Fields:**

we can combine two dimension fields to create one field. This combined field has a name which is a combination of the individual fields. The values in the dimension get combined to a single value by joining the two strings into one string separated by a comma. However, this default



name can be changed by using the rename field operation. The following diagram shows the step to combine two fields.

The screenshot shows the Tableau Data Editor interface. On the left, the 'Dimensions' pane lists 'Order', 'Location', and 'Product' categories. Under 'Location', 'Country' is selected and highlighted in blue. A context menu is open over 'Country', with 'Create' expanded to show 'Calculated Field...' and 'Combined Field'. The main workspace is empty, with three 'Drop field here' placeholder boxes.

### Checking the Metadata:

After connecting to a data source, Tableau presents all possible tables and columns present in the source. Consider the source 'Sample Coffee shop' for checking the metadata. Click the Data menu and choose to connect to a data source. Browse for the MS access file named 'Sample - Coffee shop'. Drag the table named Product to the data canvas. On choosing the file, you get



the following screen which shows the column names, their data types. The string data types are shown as **Abc** and Numeric data types are shown as below.

The screenshot shows the Tableau Data Source interface for a connection named "Product (Sa...)" to an Access database. The "Table" section displays the "Product" table with four columns: "Product Type" (Abc), "Product" (Abc), "# (Product Id)" (#), and "Product Type" (Abc). The data preview shows five rows of coffee-related products. A context menu is open over the fourth row, showing options like "Edit formula" and "Go to Worksheet". The bottom navigation bar includes tabs for "Data Source" (selected) and "Sheet1".

Product Type	Product	# (Product Id)	Product Type
Coffee	Amaretto	1	Regular
Coffee	Columbian	2	Regular
Coffee	Decaf Irish Cream	3	Decaf
	Caffe Latte	4	Regular
	Caffe Mocha	5	Regular

## Changing the Data Type

You can change the datatype of some of the fields if required. Depending on the nature of source data, sometimes Tableau may fail to recognize the data type from the source. In such scenarios, we can manually edit the data type. The following screenshot shows the option.



Tableau - Book1

File Data Server Window Help

Product (Sa... Connection Live Extract Filters 0 Add...

Connected to Access

Database File Sample - C... Table Enter table... Sort fields Data sou... Show a... Show h... Row 13

Product

Abc Product Type

Coffee

Coffee

Coffee

Go to Worksheet

Abc #

Number (Decimal)

Number (Whole)

Date & Time

Date

String

Default

Geographic Role

Id Abc Product Type

1 Regular

2 Regular

3 Decaf

4 Regular

5 Regular

Data Source Sheet1

Enter formula

## Renaming and Hiding

The column names can be changed by using the renaming option. You can also hide a column so that it does not appear in the data view that you create. These options are available by clicking on the data type icon in the metadata grid as shown in the following screenshot.



The screenshot shows the Tableau Data pane for a connection named 'Product (Sa...)' to an Access database. The 'Product' table is selected. A context menu is open over the 'Product Type' column, listing options like Rename, Copy, Hide, Aliases..., Create Calculated Field..., and Describe... . The 'Data source' tab is selected at the bottom.

## Column Alias

Each column of the data source can be assigned an alias which helps better understand the nature of the column. You can choose the aliases option from the above step and the following screen comes up which is used to create or edit aliases.

The screenshot shows the 'Edit Aliases [Product Type]' dialog box in Tableau. It lists columns with their current names and proposed aliases:

Member	Has Alias	Value (Alias)
Coffee		Coffee
Espresso		Espresso
Herbal Tea		Herbal Tea
Tea		High Tea

Buttons for OK, Cancel, and Clear Aliases are visible.

**Data joining** is a very common requirement in any data analysis. You may need to join data from multiple sources or join data from different tables in a single source. Tableau provides the feature to join the table by using the data pane available under Edit Data Source in the Data menu.



### Creating a Join:

Consider the data source ‘Sample superstore’ to create a join between Orders and Returns table. For this, go to the Data menu and choose the option Edit Data Source. Next, drag the two tables, Orders and Returns to the data pane. Depending on the field name and datatype, Tableau will automatically create a join which can be changed later.

The following screenshot shows the creation of an inner join between Orders and Returns using the Field Order ID.

The screenshot shows the Tableau Data Source editor window titled 'Tableau - Book2'. The 'Workbook' section shows 'Sample - Su...' connected to Excel. The 'Connection' dropdown is set to 'Live'. The 'Filters' section shows 0 filters with an 'Add...' button. In the main pane, there are two nodes: 'Orders' and 'Returns', connected by a line with a blue circle in the middle, indicating an 'Inner Join'. A tooltip box over the join line says 'Inner Join of "Orders and Returns"' and 'Order ID = Order ID (Returns)'. Below the nodes is a table with the following data:

Field Name	Table	Remote Field Name
Abc Order ID	Orders	Order ID
Order Date	Orders	Order Date
Ship Date	Orders	Ship Date
Abc Ship Mode	Orders	Ship Mode
Abc Customer Name	Orders	Customer Name
Abc Segment	Orders	Segment

At the bottom, there are tabs for 'Data Source' and 'Sheet 1', along with various toolbar icons.

### Editing a Join Type:

The type of join which the table creates automatically can be changed manually. For this, click the middle of the two circles showing the join. A popup window appears below which shows the four types of joins available. Also Tableau automatically greys out some types of joins, which it finds irrelevant on the basis of data present in the data source.



In the following screenshot, you can see the inner and left outer join as the available joins.

The screenshot shows the Tableau Data Source editor for a connection named "Sample - Su...". The "Orders" and "Returns" tables are joined on the "Order ID" field. The join type is currently set to "Left". Other options shown are "Inner", "Right", and "Full Outer".

Join	Data Source	Returns
Inner	Order ID	= Order ID (Returns)
Left		
Right		
Full Outer		

Field Name

Abc Order ID	Orders	Order ID
Order Date	Orders	Order Date
Ship Date	Orders	Ship Date
Ship Mode	Orders	Ship Mode
Customer Name	Orders	Customer Name
Segment	Orders	Segment

Data Source Sheet1



## **PROGRAM 3:**

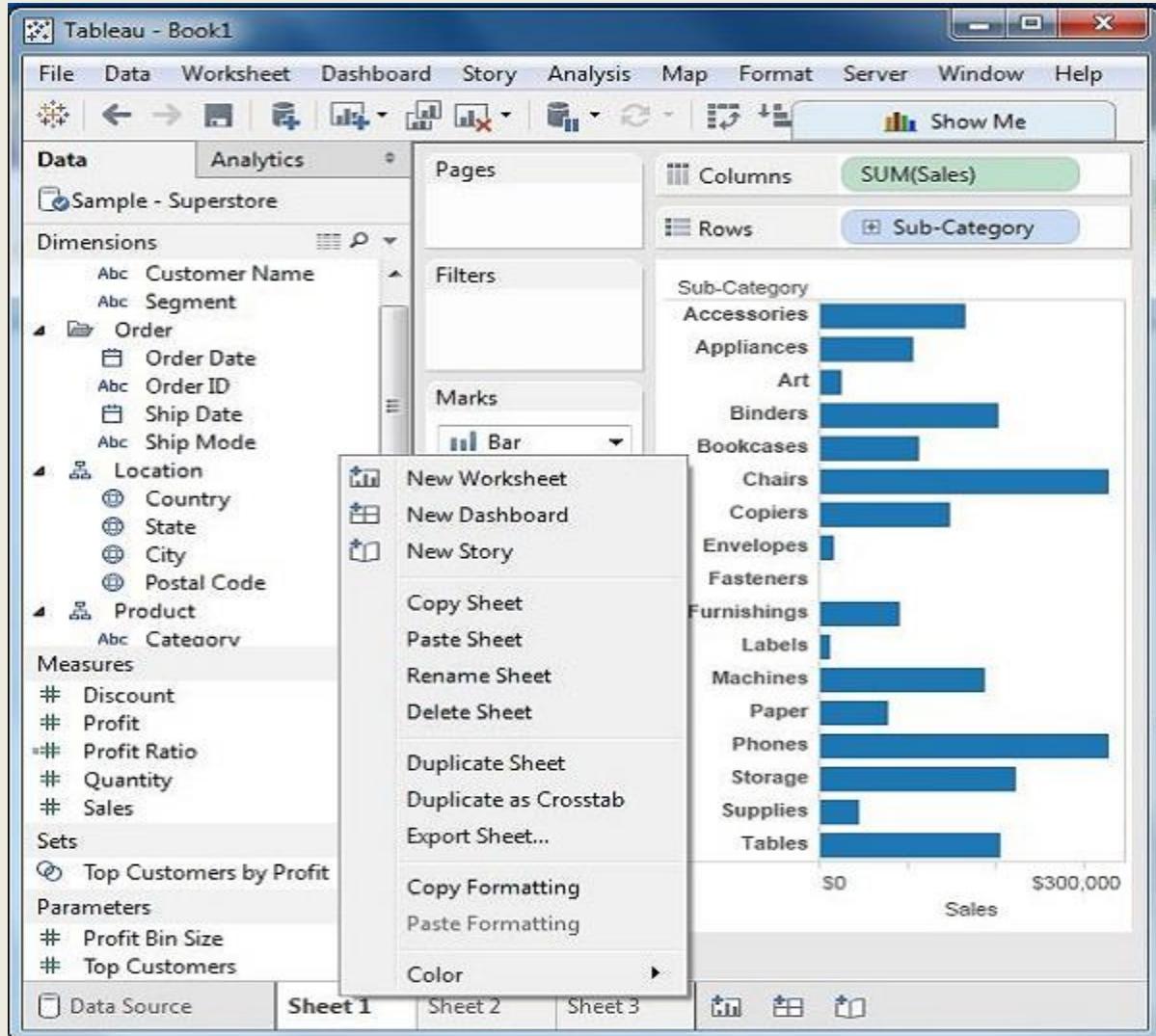
### **Working on worksheets:**

Worksheet in the Tableau screen is the area where you create the views for data analysis. By default, Tableau provides three blank worksheets when you have established a connection to data source. You can go on adding multiple worksheets to look at different data views in the same screen, one after another.

### **Adding a Worksheet:**

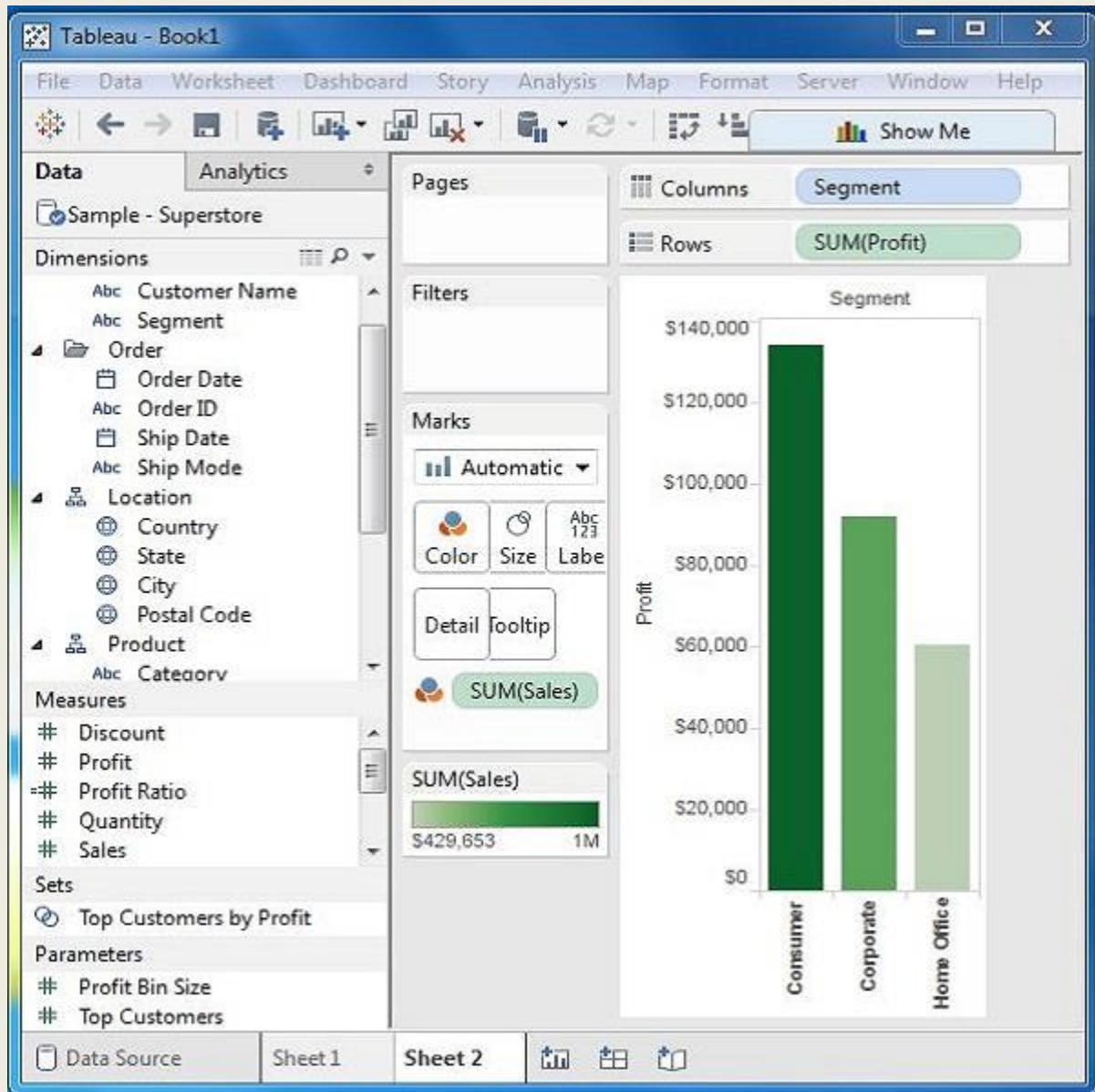
We can add a worksheet in two ways. Right-click on the name of the current worksheet and choose the option New Worksheet from the pop-up menu. We can also click on the small icon to the right of the last sheet name to add a worksheet.

# DV LAB



## Quick Preview of a Worksheet:

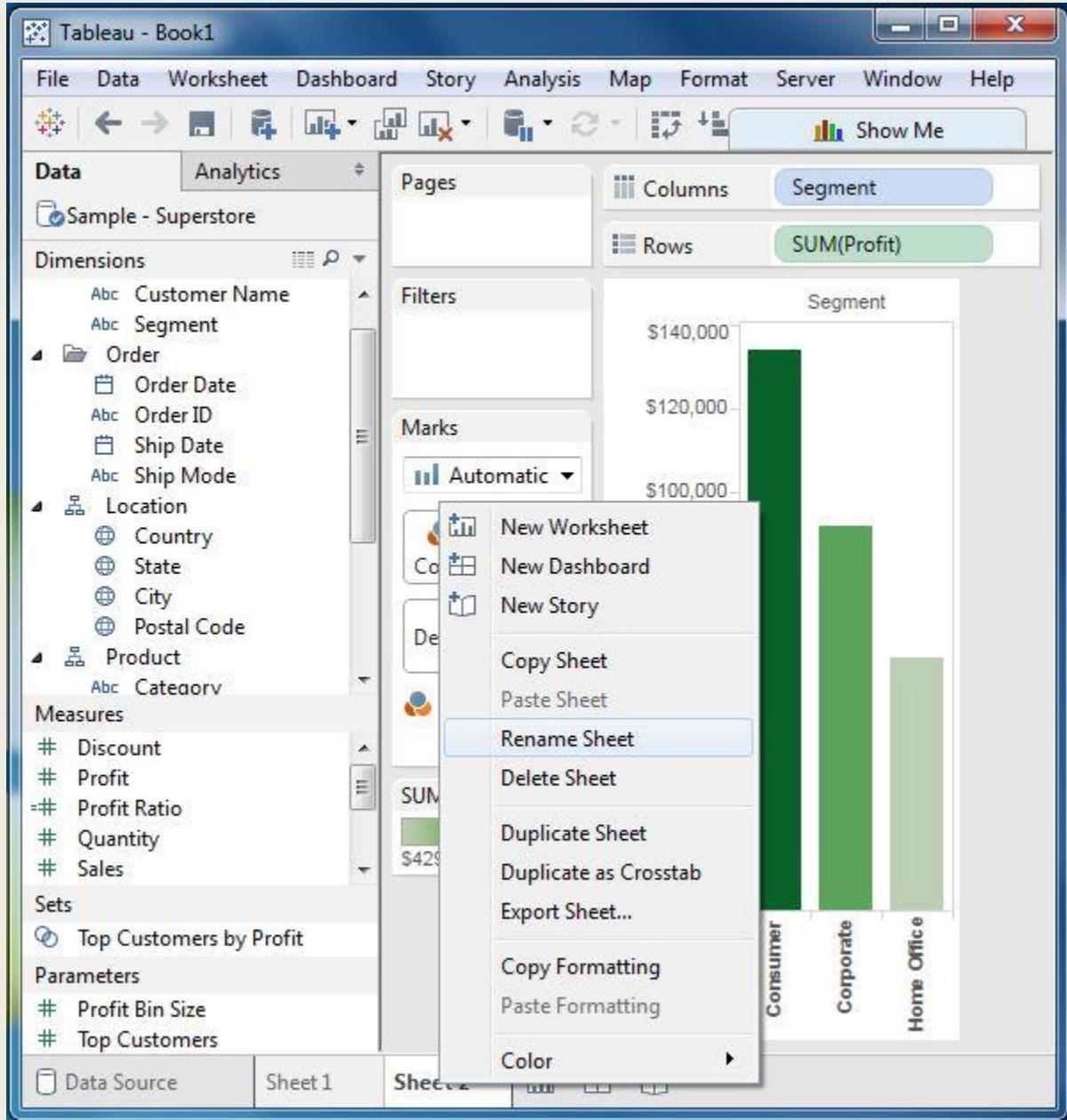
Staying in one worksheet, you can have a quick preview of another worksheet by hovering the mouse on the name of the other worksheet.



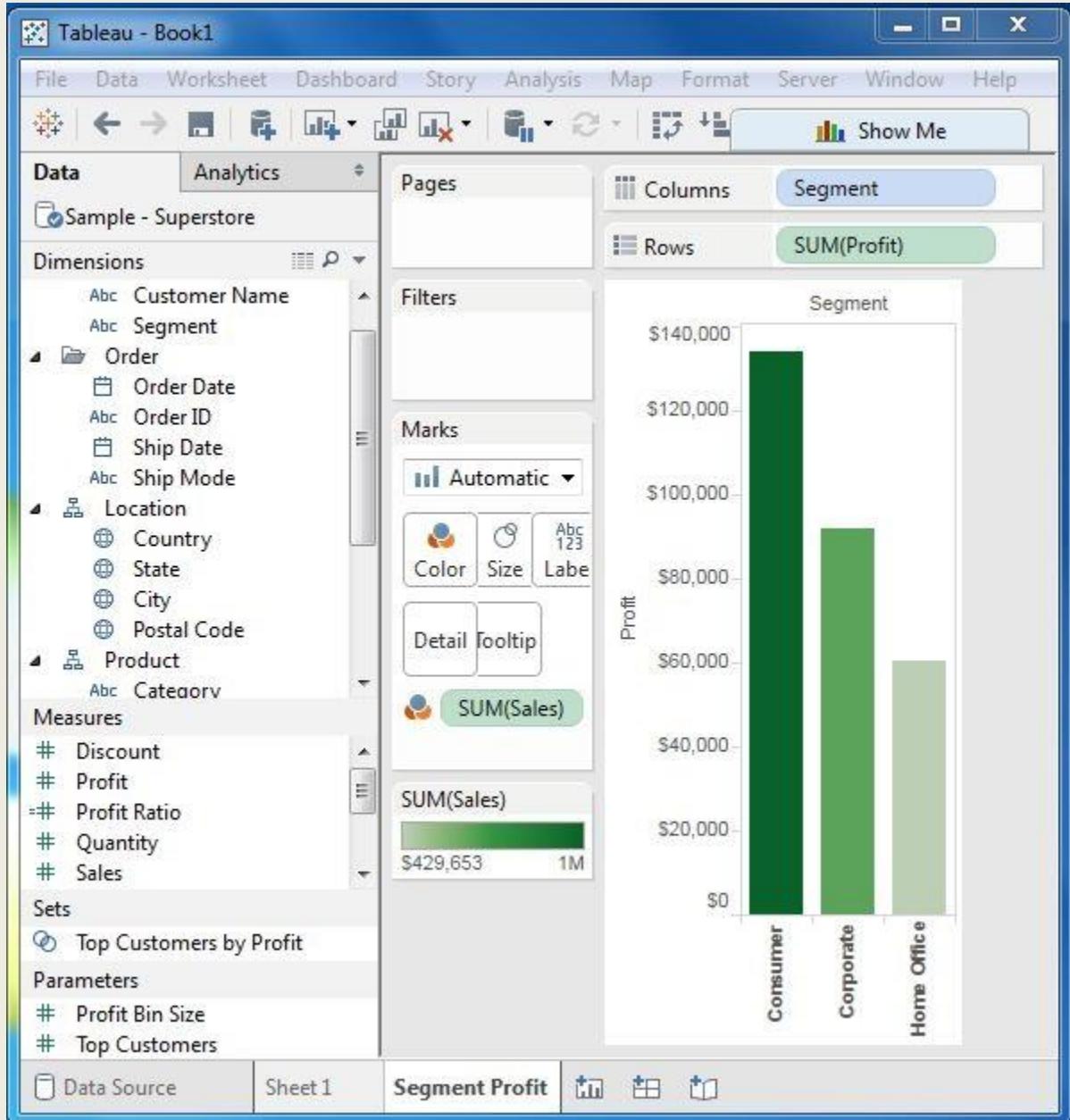
You can give appropriate names to the existing worksheets by renaming a worksheet. This helps in relating the content of the worksheet with its name. For example, if we want to know which sheet has the view to know the segment wise profit then with a proper name of the sheet we can identify it.

### **Renaming the Worksheet:**

To rename a worksheet, right-click the sheet name and choose the option Rename Sheet.



The following diagram shows the worksheet with the new name.



An existing worksheet can be both saved and deleted. This helps in organizing the contents in the Tableau desktop environment. While you can save a worksheet by clicking the save button under the main menu, you can delete a worksheet using the following steps.

### **Deleting the Worksheet:**



To delete a worksheet, right-click on name of the worksheet and choose the option ‘Delete Sheet’.

The screenshot shows the Tableau interface with a bar chart titled 'Segment'. The chart has two bars: 'Corporate' (dark green) and 'Home Office' (light green). The y-axis ranges from \$120,000 to \$140,000. The 'Corporate' bar is at approximately \$140,000 and the 'Home Office' bar is at approximately \$125,000. A context menu is open over the 'Corporate' bar, listing options: New Worksheet, New Dashboard, New Story, Copy Sheet, Paste Sheet, Rename Sheet, Delete Sheet (which is highlighted in blue), Duplicate Sheet, Duplicate as Crosstab, Export Sheet..., Copy Formatting, Paste Formatting, and Color.

Tableau - Book1

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

Data Analytics

Sample - Superstore

Dimensions

- Abc Customer Name
- Abc Segment
- Order
  - Order Date
  - Order ID
  - Ship Date
  - Ship Mode
- Location
  - Country
  - State
  - City
  - Postal Code
- Product

Measures

- # Discount
- # Profit
- # Profit Ratio
- # Quantity

Sets

- Top Customers by Profit

Parameters

- # Profit Bin Size
- # Top Customers

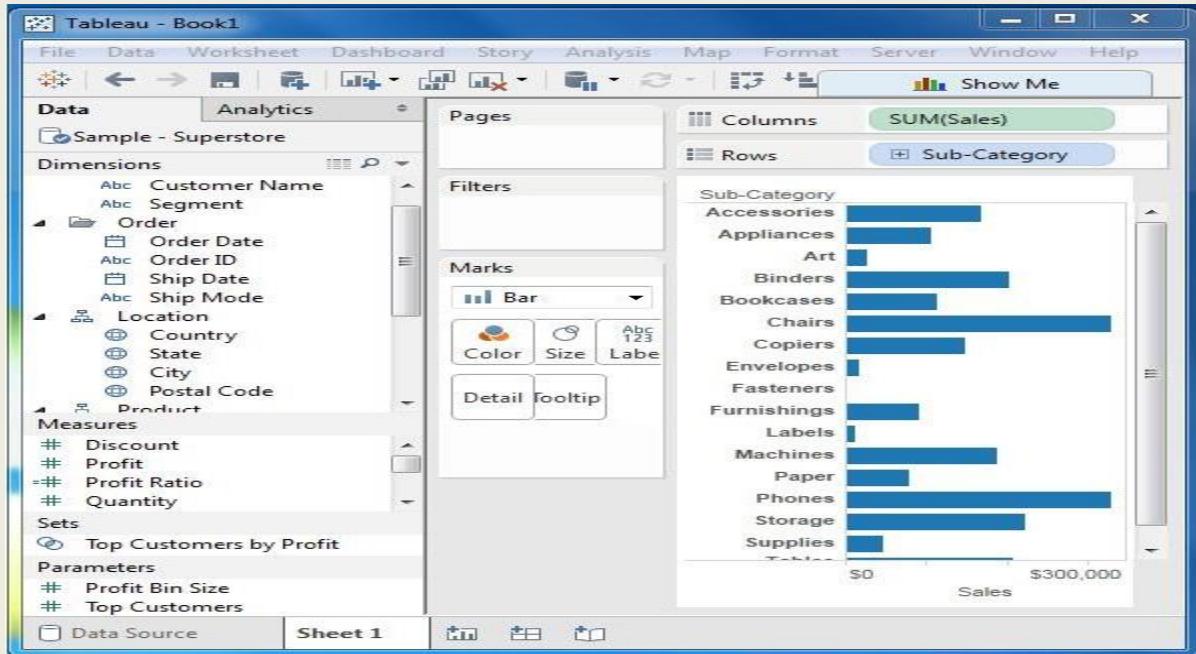
Data Source Sheet 1 Segment Front

Corporate Home Office

New Worksheet  
New Dashboard  
New Story  
Copy Sheet  
Paste Sheet  
Rename Sheet  
**Delete Sheet**  
Duplicate Sheet  
Duplicate as Crosstab  
Export Sheet...  
Copy Formatting  
Paste Formatting  
Color



The following screenshot shows the worksheet has been deleted.



Sometimes you need to change the position of the existing worksheet to study them in a better way. This can be done in a simple way by dragging the sheet name from its existing position to the new position.

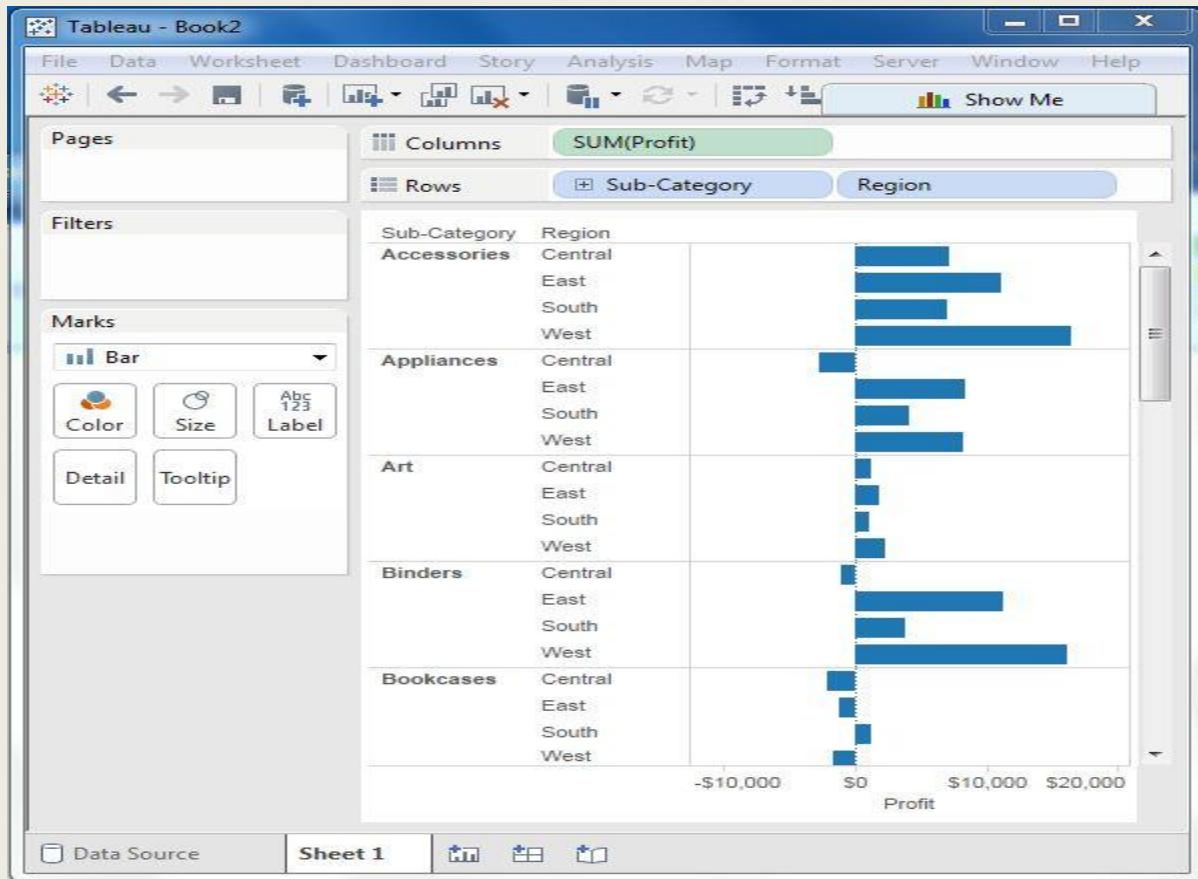
The following screenshot shows that a vertical dark line appears in the new position on dragging the third worksheet from left to the new position.

A paged workbook is used to save the view of the data in different pages for different values of the dimension or measure. A common example is to see how each type of products have performed against each other in a specific sales region. As each of the values of product type is stored as a separate page, we can view them one at a time or see it as a range of values.

### **Creating Paged Workbook:**

The paged workbook contains worksheets which have fields put in the page shelf. Consider an example of studying the profit of various sub-category of products in different regions. Following are the steps.

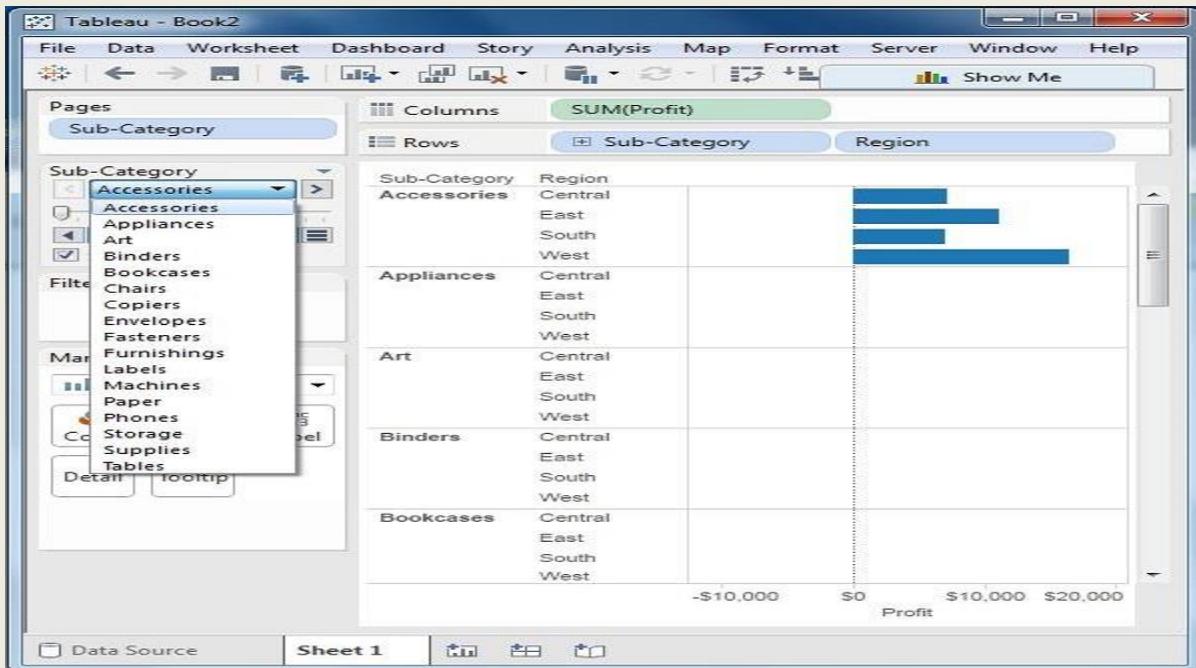
**Step 1 –** Create a bar chart with two dimensions and one measure. In this case, drag the Measure Profit to the columns shelf and the dimensions sub-category, and Region to the rows shelf as shown in the following screenshot.



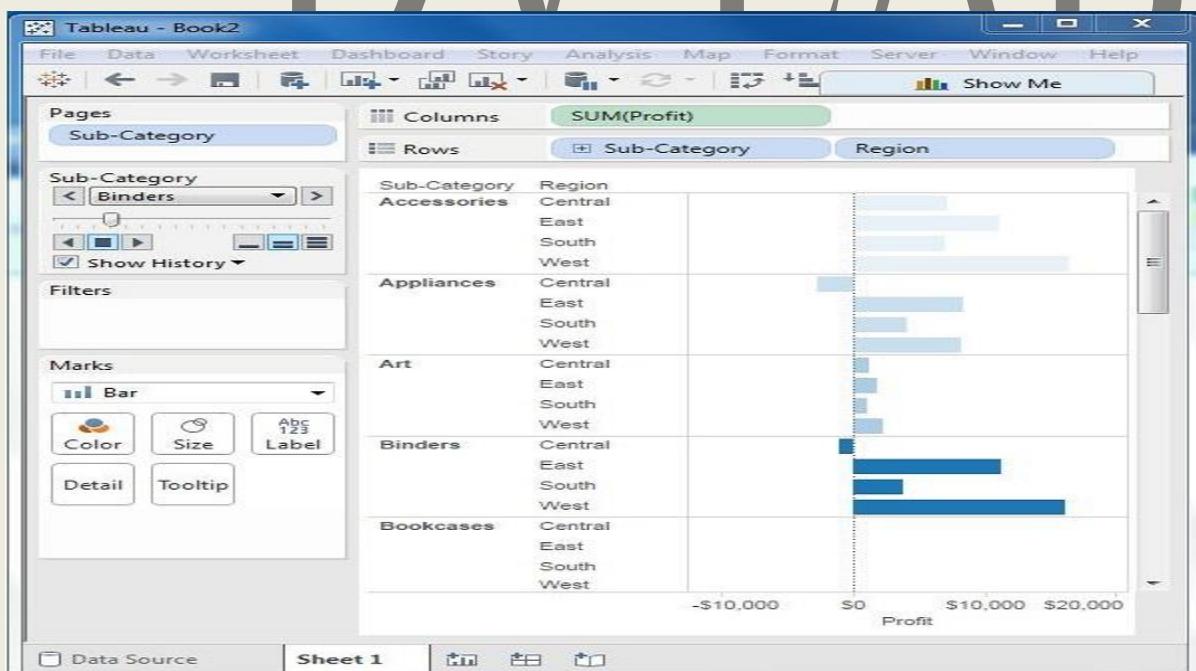
**Step 2 – Drag the Sub-Category field again to the page shelf. You will see that a page control is automatically added, just below the Pages shelf. This page control provides the following features to navigate through the pages in a view –**

- Jump to a specific page
- Manually advance through the pages
- Automatically advance through pages

In this case, we will see how to jump to a specific page and how to get the automatic display of pages. To go to a specific page, click on the drop-down on the page control and select Accessories. The chart seen in the following screenshot appears.



**Step 3 –** For automatic display of pages, keep the show history checkbox ticked and click the play button. You can then see an automatic play of different pages of sub categories. While the current Sub-Category value is shown with a dark color, the previous values are shaded with light color. The following screenshot illustrates this.





## **PROGRAM 3:**

**AIM:- Applying the Calculations (Operators, Functions, Numerical Calculations, String, Date, Table).**

**Explanation:** An operator is a symbol that tells the compiler to perform specific mathematical or logical manipulations. Tableau has a number of operators used to create calculated fields and formulas.

Following are the details of the operators that are available and the order (precedence) of operations.

### **Types of Operator**

- General Operators
- Arithmetic Operators
- Relational Operators
- Logical Operators

### **General Operators:**

Following table shows the general operators supported by Tableau. These operators act on numeric, character, and date data types.

Operator	Description	Example
+(addition)	Adds two numbers. Concatenates two strings. Adds days to dates.	$7 + 3$ Profit + Sales 'abc' + 'def' = 'abcdef' $\#April\ 15,\ 2004\# + 15$ = $\#April\ 30,$ $2004\#$
- (subtraction)	Subtracts two numbers. Subtracts days from dates.	$-(7+3) = -10$ $\#April\ 16,\ 2004\# - 15$ = $\#April\ 1,$ $2004\#$



## Arithmetic Operators:

Following table shows the arithmetic operators supported by Tableau. These operators act only on numeric data types.

Operator	Description	Example
<b>*(Multiplication)</b>	Numeric multiplication	$23 * 2 = 46$
<b>/ (Division)</b>	Numeric division	$45 / 2 = 22.5$
<b>% (modulo)</b>	Reminder of numeric division	$13 \% 2 = 1$
<b>^(power)</b>	Raised to the power	$2^3 = 8$

## Comparison Operators:

Following table lists the comparison operators supported by Tableau. These operators are used in expressions. Each operator compares two numbers, dates, or strings and returns a Boolean (TRUE or FALSE). Booleans themselves, however, cannot be compared using these operators.

Operator	Description	Example
<b><math>= =</math> or <math>=</math> (Equal to)</b>	Compares two numbers or two strings or two dates to be equal. Returns the Boolean value TRUE if they are, else returns false.	$'Hello' = 'Hello'$ $5 = 15 / 3$
<b><math>\neq</math> or <math>\neq</math> (Not equal to)</b>	Compares two numbers or two strings or two dates to be unequal. Returns the Boolean value TRUE if they are, else returns false.	$'Good' \neq 'Bad'$ $18 \neq 37 / 2$
<b><math>&gt;</math> (Greater than)</b>	Compares two numbers or two strings or two dates where the first argument is greater than second. Returns the boolean value TRUE if it is the case, else returns false.	$[Profit] > 20000$ $[Category] > 'Q'$ $[Ship date] > #April 1, 2004#$
<b><math>&lt;</math> (Less than)</b>	Compares two numbers or two strings or two dates where the first argument is smaller than second. Returns the boolean value TRUE if it is the case, else returns	$[Profit] < 20000$ $[Category] < 'Q'$ $[Ship date] < #April 1, 2004#$



false.

### Logical Operators:

Following table shows the logical operators supported by Tableau. These operators are used in expressions whose result is a Boolean giving the output as TRUE or FALSE.

Operator	Description	Example
AND	If the expressions or Boolean values present on both sides of AND operator is evaluated to be TRUE, then the result is TRUE. Else the result is FALSE.	[Ship Date] > #April 1, 2012# AND [Profit] > 10000
OR	If any one or both of the expressions or Boolean values present on both sides of AND operator is evaluated to be TRUE, then the result is TRUE. Else the result is FALSE.	[Ship Date] > #April 1, 2012# OR [Profit] > 10000
NOT	This operator negates the Boolean value of the expression present after it.	NOT [Ship Date] > #April 1, 2012#

DVILAB

### Operator Precedence:

The following table describes the order in which operators are evaluated. The top row has the highest precedence. Operators on the same row have the same precedence. If two operators have the same precedence, they are evaluated from left to right in the formula. Also parentheses can be used. The inner parentheses are evaluated before the outer parentheses.

Precedence	Operator
1	-(negate)
2	^(power)
3	*, /, %



4	+, -
5	==, >, <, >=, <=, !=
6	NOT
7	AND
8	OR

Any data analysis involves a lot of calculations. In Tableau, the calculation editor is used to apply calculations to the fields being analyzed. Tableau has a number of inbuilt functions which help in creating expressions for complex calculations.

Following are the description of different categories of functions.

- Number Functions
- String Functions
- Date Functions
- Logical Functions
- Aggregate Functions

# DV LAB

## Number Functions:

These are the functions used for numeric calculations. They only take numbers as inputs. Following are some examples of important number functions.

Function	Description	Example
<b>CEILING (number)</b>	Rounds a number to the nearest integer of equal or greater value.	CEILING(2.145) = 3
<b>POWER (number, power)</b>	Raises the number to the specified power.	POWER(5,3) = 125
<b>ROUND (number, [decimals])</b>	Rounds the numbers to a specified number of digits.	ROUND(3.14152,2) = 3.14

## String Functions:



String Functions are used for string manipulation. Following are some important string functions with examples

Function	Description	Example
<b>LEN (string)</b>	Returns the length of the string.	LEN("Tableau") = 7
<b>LTRIM (string)</b>	Returns the string with any leading spaces removed.	LTRIM(" Tableau ") = "Tableau"
<b>REPLACE (string, substring, replacement)</b>	Searches the string for substring and replaces it with a replacement. If the substring is not found, the string is not changed.	REPLACE("GreenBlueGreen", "Blue", "Red") = "GreenRedGreen"
<b>UPPER (string)</b>	Returns string, with all characters uppercase.	UPPER("Tableau") = "TABLEAU"

# DVLAB

### Date Functions:

Tableau has a variety of date functions to carry out calculations involving dates. All the date functions use the **date\_part** which is a string indicating the part of the date such as - month, day, or year. Following table lists some examples of important date functions.

Function	Description	Example
<b>DATEADD (date_part, increment, date)</b>	Returns an increment added to the date. The type of increment is specified in <b>date_part</b> .	DATEADD ('month', 3, #2004-04-15#) = 2004-0715 12:00:00 AM
<b>DATENAME (date_part, date, [start_of_week])</b>	Returns <b>date_part</b> of date as a string. The <b>start_of_week</b> parameter is optional.	DATENAME('month', #200404-15#) = "April"
<b>DAY (date)</b>	Returns the day of the given date as an integer.	DAY(#2004-04-12#) = 12



<b>NOW()</b>	Returns the current date and time.	NOW( ) = 2004-04-15 1:08:21 PM
--------------	------------------------------------	-----------------------------------

### **Logical Functions:**

These functions evaluate some single value or the result of an expression and produce a boolean output.

Function	Description	Example
<b>IFNULL (expression1, expression2)</b>	The IFNULL function returns the first expression if the result is not null, and returns the second expression if it is null.	IFNULL([Sales], 0) = [Sales]
<b>ISDATE (string)</b>	The ISDATE function returns TRUE if the string argument can be converted to a date, and FALSE if it cannot.	ISDATE("11/05/98") = TRUE ISDATE("14/05/98") = FALSE
<b>MIN(expression)</b>	The MIN function returns the minimum of an expression across all records or the minimum of two expressions for each record.	D V I A B

### **Aggregate Functions:**

Function	Description	Example
<b>AVG(expression)</b>	Returns the average of all the values in the expression. AVG can be used with numeric fields only. Null values are ignored.	
<b>COUNT (expression)</b>	Returns the number of items in a group. Null values are not counted.	
<b>MEDIAN (expression)</b>	Returns the median of an expression across all records. Median can only be used with numeric	



	fields. Null values are ignored.	
<b>STDEV (expression)</b>	Returns the statistical standard deviation of all values in the given expression based on a sample of the population.	

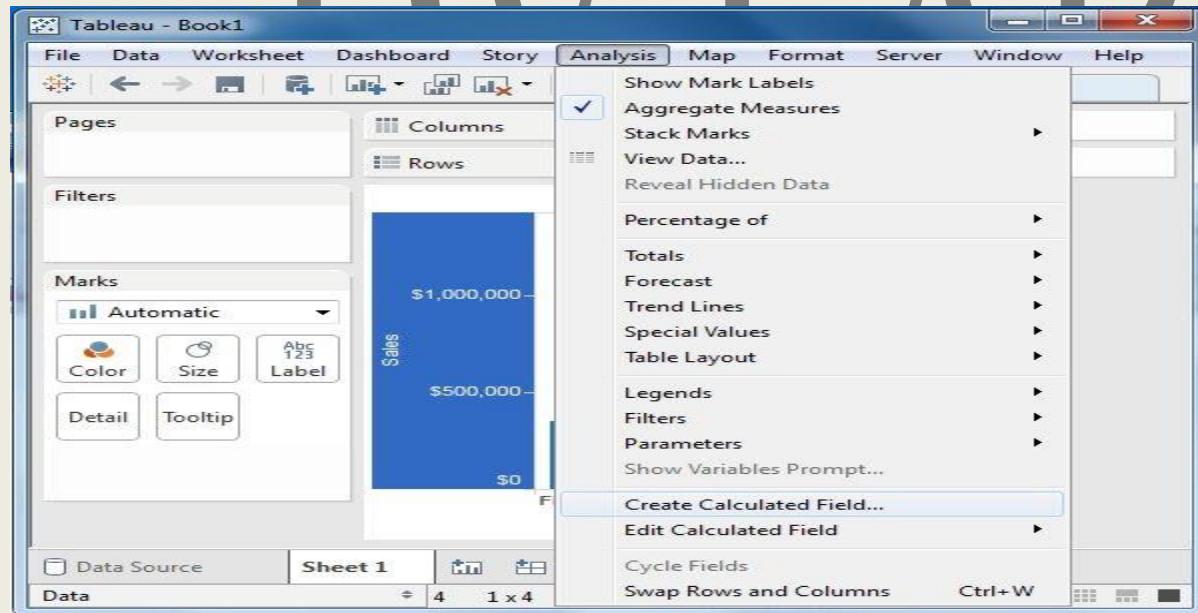
Numeric calculations in Tableau are done using a wide range of inbuilt functions available in the formula editor.

In this chapter, we will see how to apply calculations to the fields. The calculations can be as simple as subtracting the values of two fields or applying an aggregate function to a single field.

Following are the steps to create a calculation field and use numeric functions in it.

## Create Calculated Field

While connected to Sample-superstore, go to the Analysis menu and click ‘Create Calculated Field’, as shown in the following screenshot.



### Calculation Editor:

The above step opens a calculation editor which lists all the functions that are available in Tableau. You can change the drop down value and see only the functions related to numbers.



The screenshot shows the Tableau software interface with a 'Calculation1' dialog box open. The dialog box contains a list of available functions under the heading 'All'. The 'ABS(number)' function is selected, with its description and example provided: 'Returns the absolute value of the given number. Example: ABS(-7) = 7'. At the bottom of the dialog box are 'Apply' and 'OK' buttons, with 'OK' being the active button.

## Create a Formula

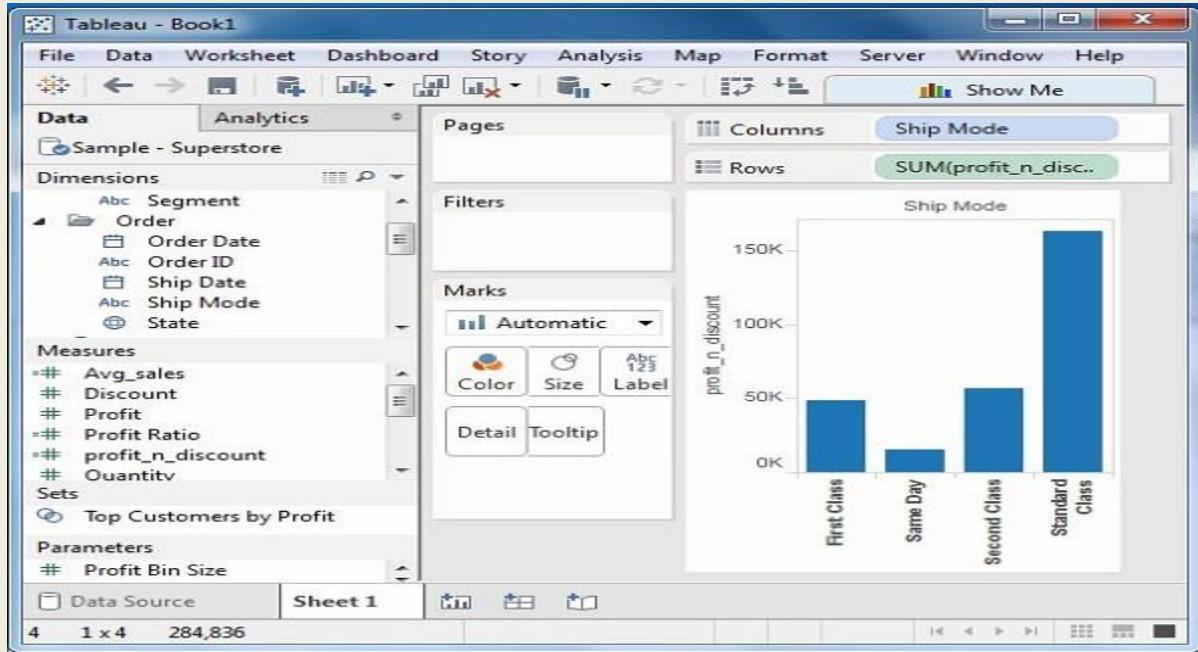
To study the difference between profit and discount for different shipping mode of the products, create a formula subtracting the discount from the profit as shown in the following screenshot. Also, name this field as **profit\_n\_discount**.

The screenshot shows the Tableau software interface with a 'Profit' calculated field being created. The 'Measures' shelf on the left lists various measures, and the 'Calculated Fields' section is open, showing the definition of the 'profit\_n\_discount' field. The formula is defined as `# Profit - # Discount`. The 'OK' button at the bottom right of the dialog box is highlighted.

A large stylized letter 'AB' is positioned on the right side of the page.

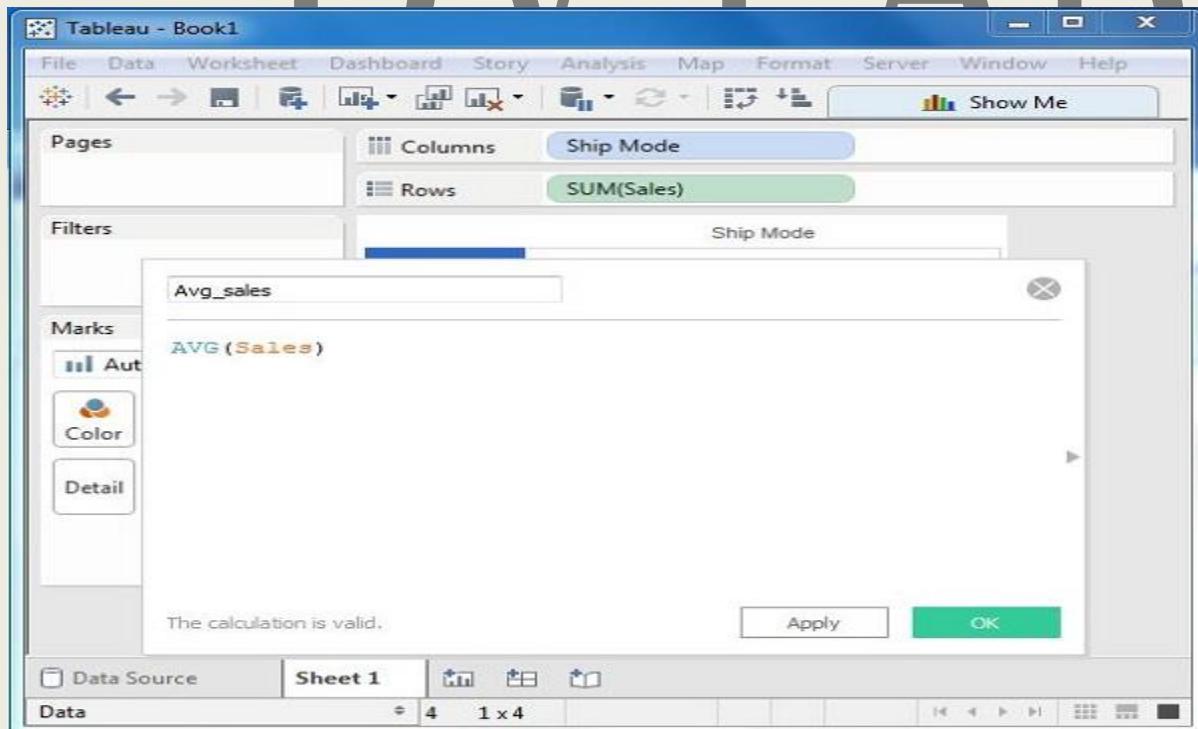
## Using the Calculated Field

The above calculated field can be used in the view by dragging it to the Rows shelf as shown in the following screenshot. It produces a bar chart showing the difference between profit and discount for different shipping modes.



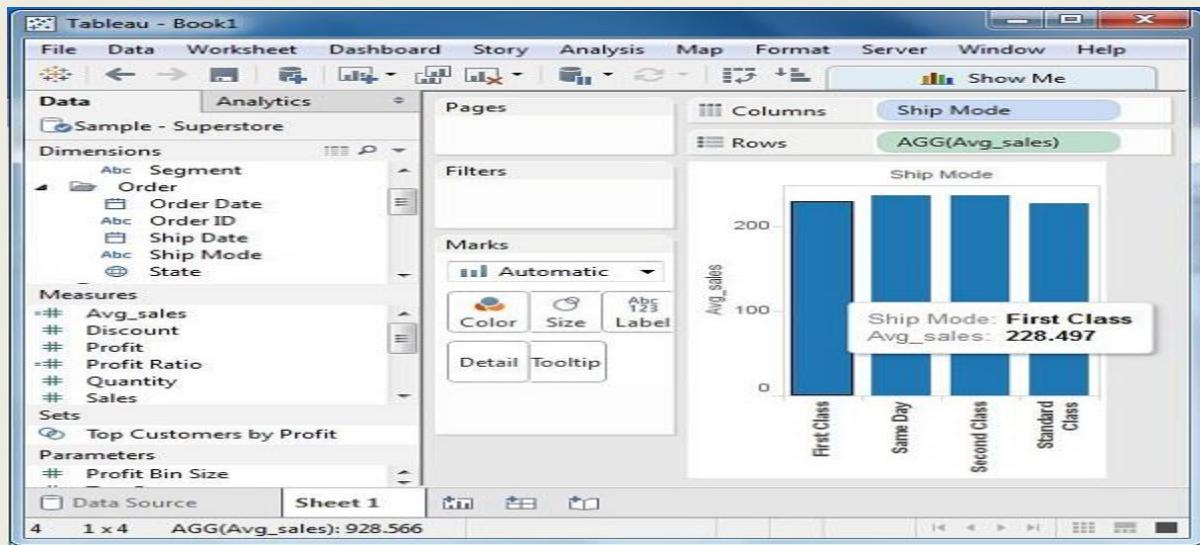
## Applying Aggregate Calculations

In a similar manner as above, you can create a calculated field using aggregate function. Here, create AVG(sales) values for different ship mode. Write the formula in the calculation editor as shown in the following screenshot.





On clicking OK and dragging the Avg\_Sales field to the Rows shelf, you will get the following view.



Next, will learn about calculations in Tableau involving Strings. Tableau has many inbuilt string functions, which can be used to do string manipulations such as - comparing, concatenating, replacing few characters from a string, etc. Following are the steps to create a calculation field and use string functions in it.

## Create Calculated Field

While connected to Sample superstore, go to the Analysis menu and click ‘Create Calculated Field’ as shown in the following screenshot.



The screenshot shows the Tableau software interface with the 'Analysis' tab selected in the top menu bar. The 'Analysis' menu is open, displaying various options such as 'Show Mark Labels', 'Aggregate Measures', 'Stack Marks', 'View Data...', 'Reveal Hidden Data', 'Percentage of', 'Totals', 'Forecast', 'Trend Lines', 'Special Values', 'Table Layout', 'Legends', 'Filters', 'Parameters', 'Show Variables Prompt...', 'Create Calculated Field...', 'Edit Calculated Field', 'Cycle Fields', and 'Swap Rows and Columns'. On the left side of the interface, there are sections for 'Pages', 'Filters', and 'Marks'.

## Calculation Editor

The above step opens a calculation editor which lists all the functions that is available in Tableau. You can change the dropdown value and see only the functions related to strings.

The screenshot shows the Tableau software interface with the 'Calculation Editor' open. The 'Analytics' tab is selected in the top menu bar. The 'String' function dropdown is open, showing various string-related functions like ASCII, CHAR, CONTAINS, ENDSWITH, FIND, FINDNTH, ISDATE, LEFT, LEN, LOWER, LTRIM, MAX, MID, MIN, DECODE, and EXTRACT. The 'CONTAINS(string, substring)' function is currently selected. The 'Calculation1' field in the editor is empty.

## Create a Formula

Consider you want to find out the sales in the cities, which contain the letter "o". For this, create the formula as shown in the following screenshot.



The screenshot shows the Tableau interface with the 'Book1' workspace open. In the top navigation bar, 'Analytics' is selected. On the left, the 'Dimensions' shelf lists 'Order' and 'city\_o'. The 'Measures' shelf contains a single calculated field: 'CONTAINS({City}, "o")'. The 'Columns' shelf has one item: 'All'. A tooltip for the 'ABS(number)' function is displayed, stating: 'Returns the absolute value of the given number. Example: ABS(-7) = 7'. At the bottom, the status bar shows '297 marks' and '297 rows by 1 column'.

## Using the Calculated Field

Now, to see the created field in action, you can drag it to the Rows shelf and drag the Sales field to the Columns shelf. The following screenshot shows the Sales values.

The screenshot shows the Tableau interface with the 'Book1' workspace open. The 'Dimensions' shelf includes 'Ship Mode', 'State', 'city\_o (True)', 'Location', 'Country', 'City', 'Postal Code', and 'Product'. The 'Measures' shelf includes 'Profit Ratio', 'profit\_n\_discount', 'Quantity', 'Sales', and 'Latitude (generated)'. The 'Columns' shelf has one item: 'SUM(Sales)'. The 'Rows' shelf has one item: 'City'. The visualization is a horizontal bar chart where each bar represents a city's total sales. The cities listed on the y-axis are Holyoke, Homestead, Hoover, Hot Springs, Houston, Huntington Beach, Indianapolis, Inglewood, Iowa City, Jackson, Jacksonville, Jamestown, and Jefferson City. The x-axis is labeled 'Sales' with tick marks at 50 and \$200,000.

Dates are one of the key fields which is extensively used in most of the data analysis scenarios. Hence, Tableau provides a large number of inbuilt functions involving dates. You can carry out simple date manipulations such as adding or subtracting days from a date. You can also create complex expressions involving dates.



Following are the steps to create a calculation field and use date functions in it.

## Create Calculated Field

While connected to Sample superstore, go to the Analysis menu and click ‘Create Calculated Field’, as shown in the following screenshot.

The screenshot shows the Tableau software interface with the 'Analysis' menu open. The 'Create Calculated Field...' option is highlighted. The main workspace displays a single blue rectangular mark with the value '\$1,000,000'.

## Calculation Editor

The above step opens a calculation editor, which lists all the functions available in Tableau. You can change the dropdown value and see only the functions related to Date.

The screenshot shows the Tableau software interface with the Calculation Editor open. The 'Date' dropdown menu is open, showing various date-related functions like DATEADD, DATEDIFF, and DATEPART. The 'DATEDIFF' function is selected. The description for 'DATEDIFF' is visible, stating it returns the difference between two dates where start\_date is subtracted from end\_date. The example provided is: DATEDIFF(month, #2004-07-15#, #2004-04-03#, 'sunday') - 3.

## Create a Formula

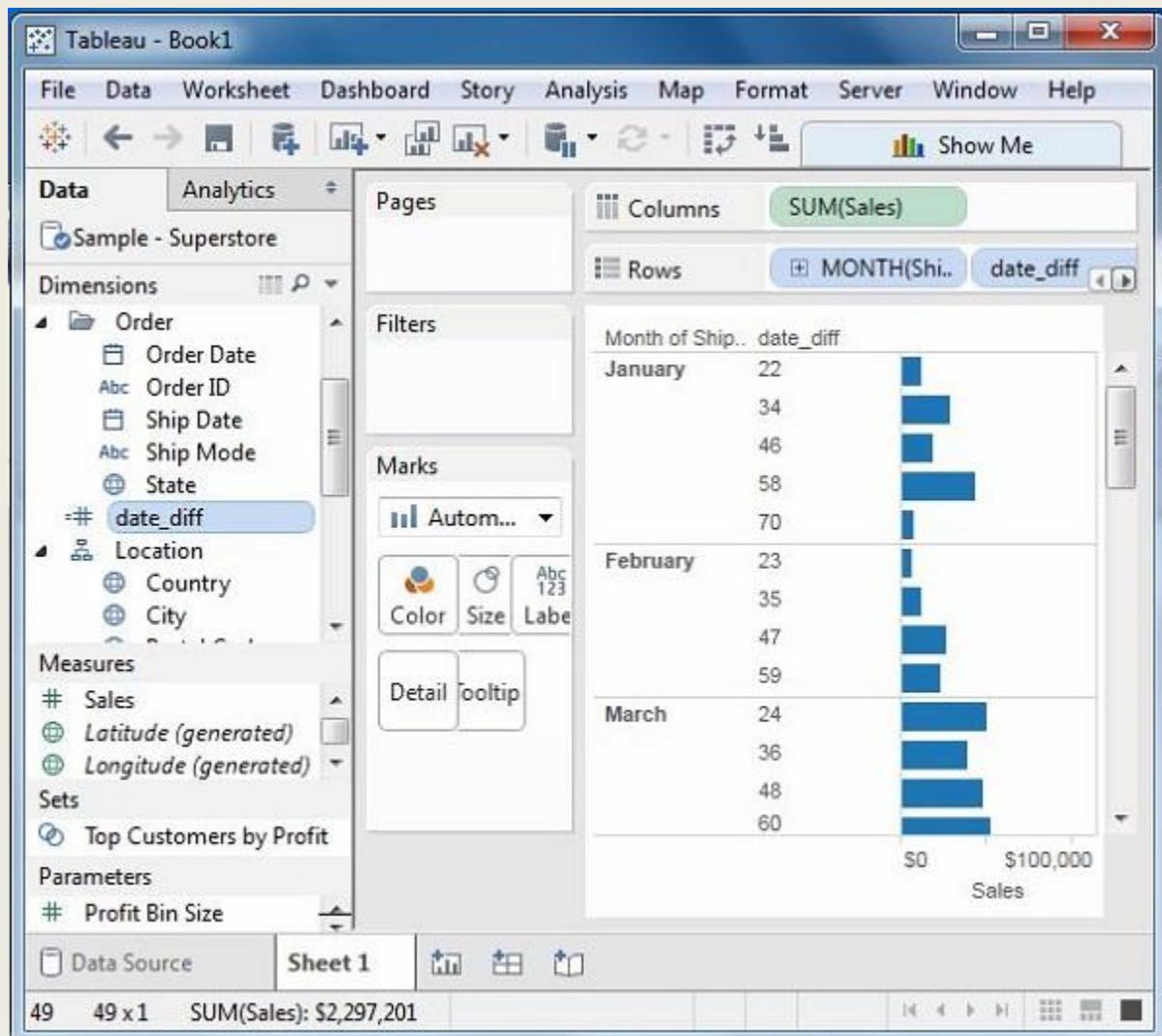


Now, find out the sales volume along with the difference in the date of sales in months from 21<sup>st</sup> March 2009. For this, create the formula as shown in the following screenshot.

The screenshot shows the Tableau interface with a calculated field editor open. The formula being typed is `DATEDIFF('month',#2009-03-21#, [Ship Date] )`. A tooltip for the `DATEDIFF` function is displayed, explaining it returns the difference between two dates where start\_date is subtracted from end\_date, expressed in units of date\_part. The example given is `DATEDIFF(month, #2004-07-15#, #2004-04-03#, 'sunday') = -3`.

## Using the Calculated Field

Now to see the created field in action, you can drag it to the Rows shelf and drag the Sales field to the Columns shelf. Also drag the ship Date with months. The following screenshot shows the Sales values.



These are the calculations which are applied to the values in the entire table. For example, for calculating a running total or running average, we need to apply a single method of calculation to an entire column. Such calculations cannot be performed on some selected rows.



Table has a feature called **Quick Table Calculation**, which is used to create such calculations. The steps to be applied in Quick Table calculation are as follows –

**Step 1** – Select the measure on which the table calculation has to be applied and drag it to column shelf.

**Step 2** – Right-click the measure and choose the option Quick Table Calculation.

**Step 3** – Choose one of the following options to be applied on the measure.

- Running Total
- Difference
- Percent Difference
- Percent of Total
- Rank
- Percentile
- Moving Average
- Year to Date (YTD) Total
- Compound Growth Rate
- Year over Year Growth
- Year to Date (YTD) Growth

# DV LAB

## PROGRAM 6 :



## **AIM:Usage of Different types of Filter & Sort.**

### **Explanation:**

Sorting of data is a very important feature of data analysis. Tableau allows the sorting of data of the fields, which are called dimensions. There are two ways in which Tableau carries out the sorting.

- **Computed Sorting** is the sort directly applied on an axis using the sort dialog button.
- **Manual Sorting** is used to rearrange the order of dimension fields by dragging them next to each other in an ad hoc fashion.

#### **Computed Sorting**

This type of sorting involves choosing a field to be sorted and directly applying the sort using the sort dialog box. You have the option to choose the sort order as ascending or descending and choose the field on which to apply the sort.

#### **Example :**

Choose Sample-Superstore to apply sorting on the field named **discount** by using the dimensions order date and Subcategory as shown below. The result shows the name of the sub-categories in a descending order arranged for each year.

#### **Manual Sorting**

This is basically changing the order in which the visualization elements appear in the screen. For example, you want to show the sales volume of different product segment in a descending order, however you have your own choice of order. This sort is not as per the exact values of number or text, rather they represent the user's choice of ordering. Hence, they are called as manual sorting.

In the following example, you move the segment named Home Office, below the segment named Consumer, even though the sales volume of Home Office is the lowest.

Filtering is the process of removing certain values or range of values from a result set. Tableau filtering feature allows both simple scenarios using field values as well as advanced calculation or context-based filters. In this chapter, you will learn about the basic filters available in Tableau.

There are three types of basic filters available in Tableau. They are as follows –

- **Filter Dimensions** are the filters applied on the dimension fields.
- **Filter Measures** are the filters applied on the measure fields.
- **Filter Dates** are the filters applied on the date fields.

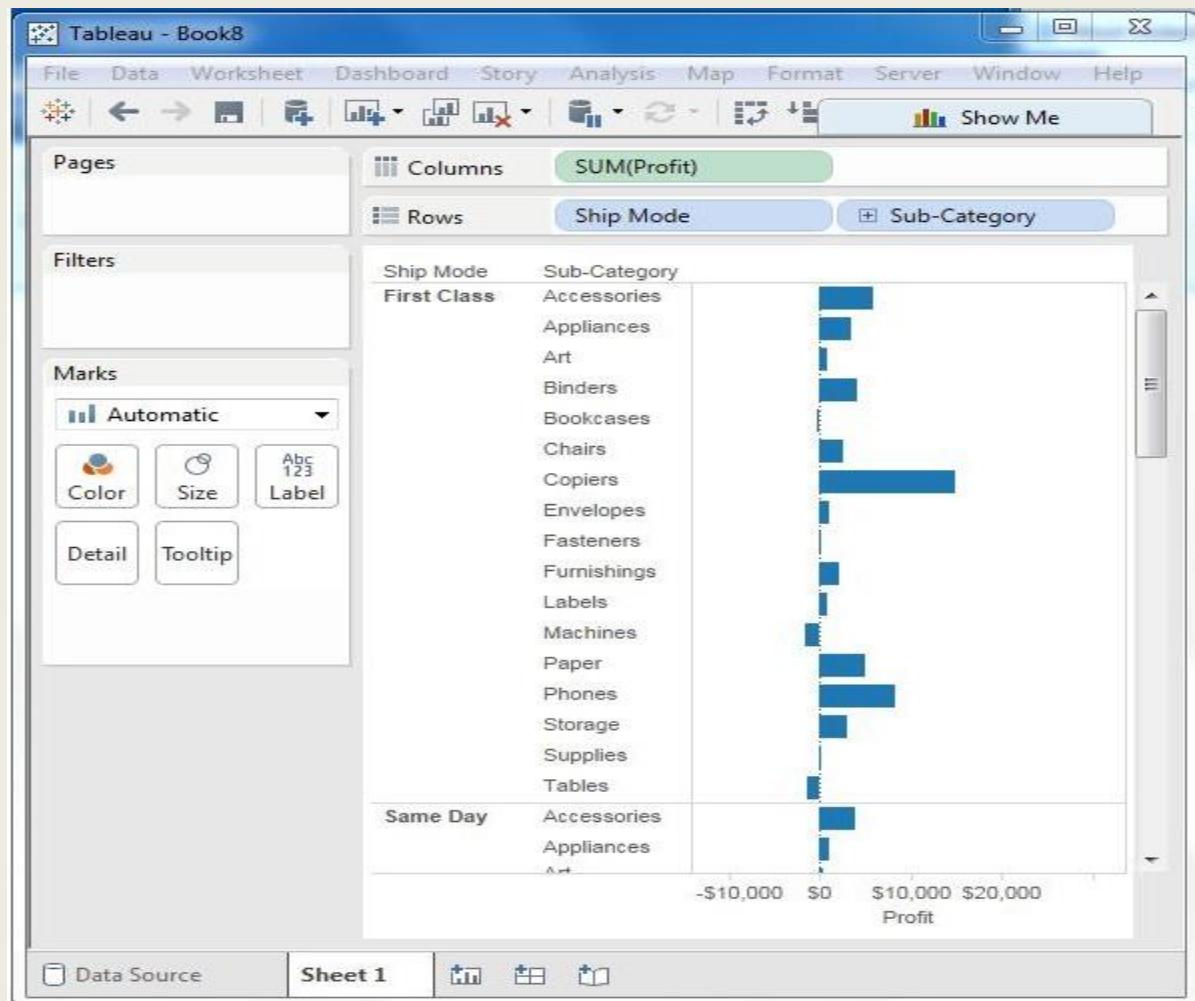
#### **Filter Dimensions**



These filters are applied on the dimension fields. Typical examples include filtering based on categories of text or numeric values with logical expressions greater than or less than conditions.

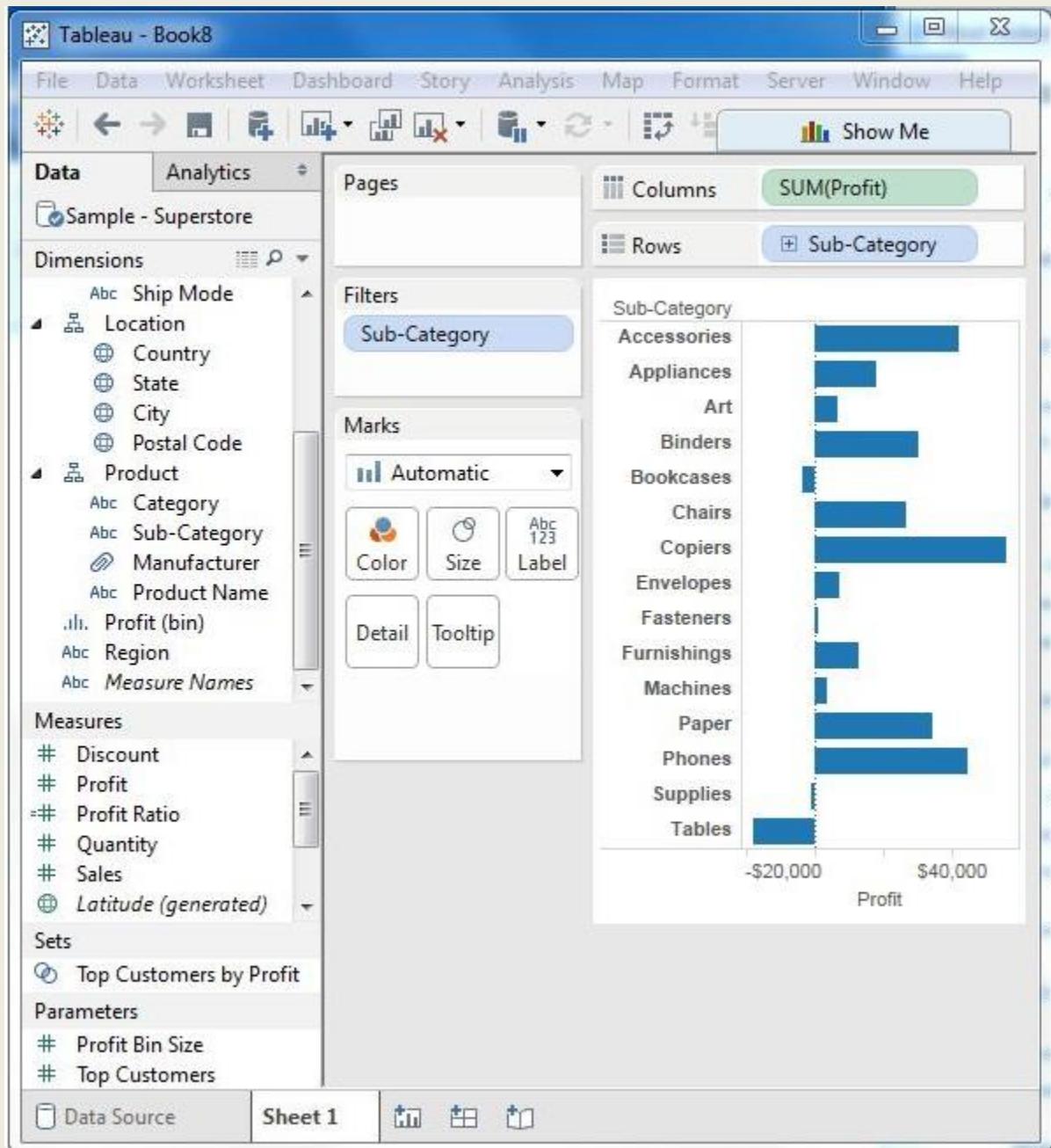
### Example:

We use the Sample - Superstore data source to apply dimension filters on the sub-category of products. We create a view for showing profit for each sub-category of products according to their shipping mode. For it, drag the dimension field “Sub-Category” to the Rows shelf and the measure field “profit” to the Columns shelf.





Next, drag the Sub-Category dimension to the Filters shelf to open the Filter dialog box. Click the None button at the bottom of the list to deselect all segments. Then, select the Exclude option in the lower right corner of the dialog box. Finally, select Labels and Storage and then click OK. The following screenshot shows the result with the above two categories excluded.



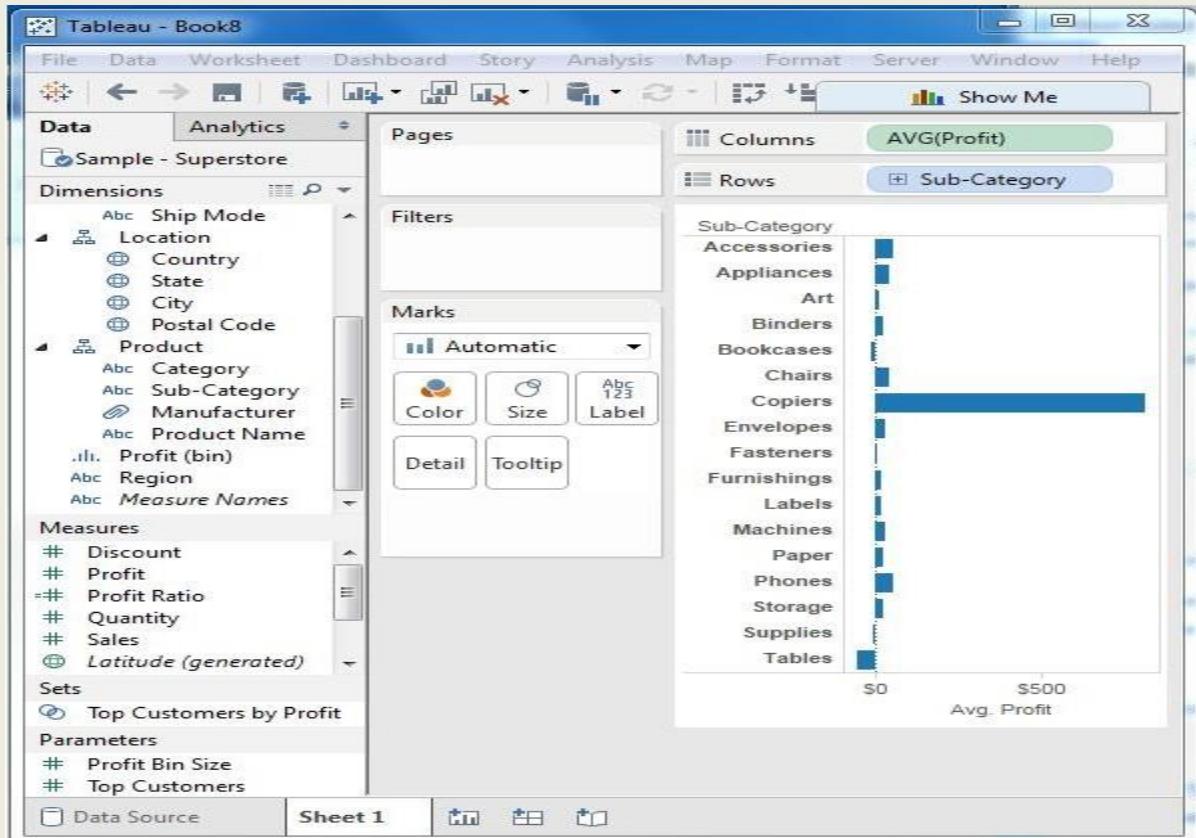


## Filter Measures

These filters are applied on the measure fields. Filtering is based on the calculations applied to the measure fields. Hence, while in dimension filters you use only values to filter, in measures filter you use calculations based on fields.

### Example:

Consider the Sample - Superstore data source to apply dimension filters on the average value of the profits. First, create a view with ship mode and subcategory as dimensions and Average of profit as shown in the following screenshot.



Next, drag the AVG (profit) value to the filter pane. Choose Average as the filter mode. Next, choose "At least" and give a value to filter the rows, which meet these criteria.



Tableau - Book8

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

Data Analytics Sample - Superstore

Dimensions

Filter [Avg. Profit]

Range of values At least At most Special

At least

20 817.909189706

-\$56 \$818 \$800

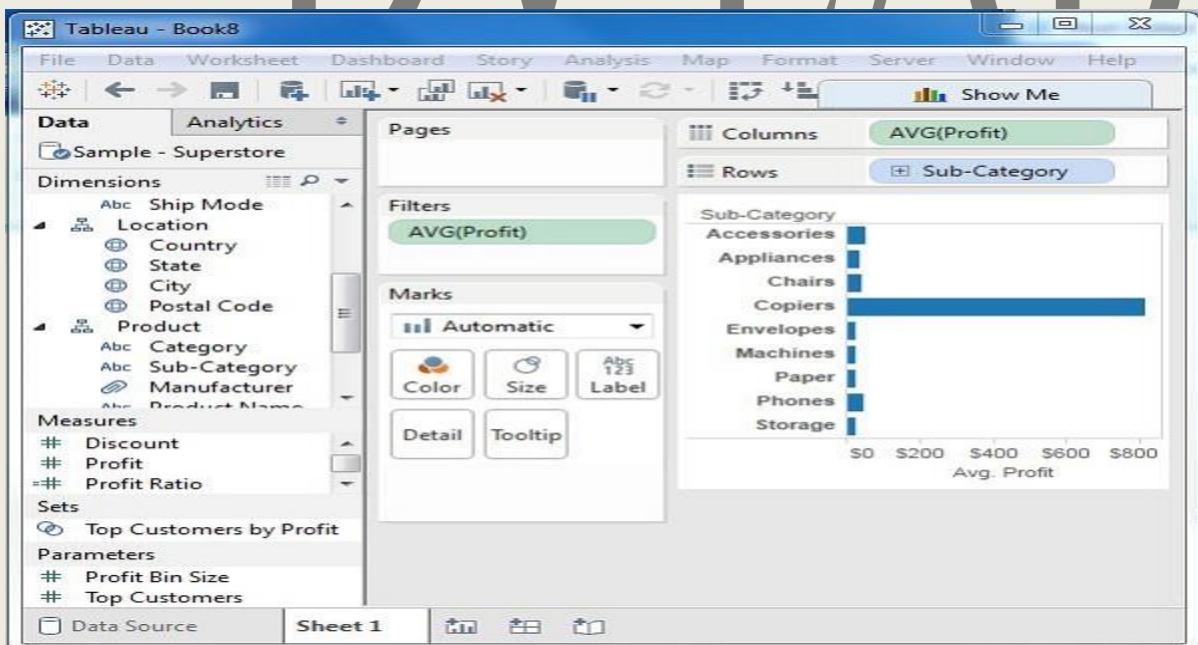
Show: Only relevant values Include Null Values

Reset OK Cancel Apply

Data Source Sheet 1

DIVAR

After completion of the above steps, we get the final view below showing only the subcategories whose average profit is greater than 20.



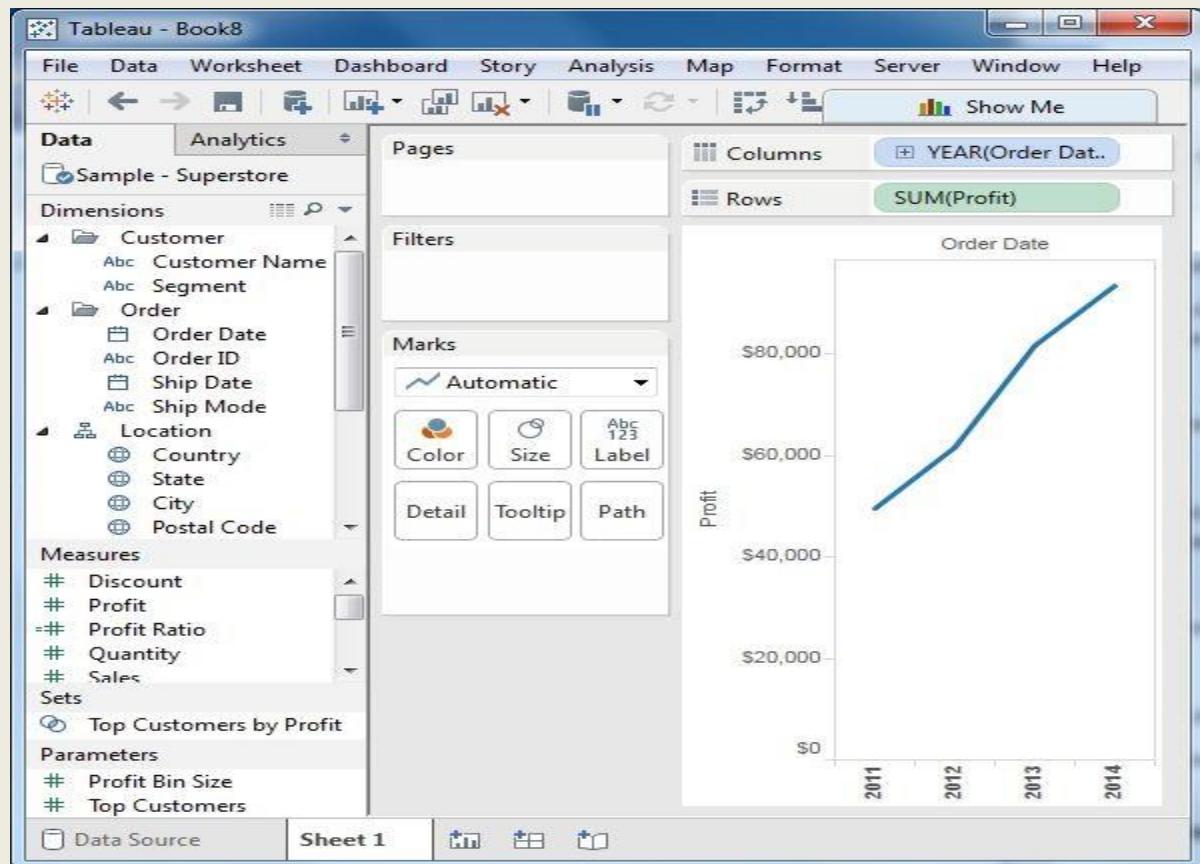


## Filter Dates

Tableau treats the date field in three different ways while applying the date field. It can apply filter by taking a relative date as compared to today, an absolute date, or range of dates. Each of this option is presented when a date field is dragged out of the filter pane.

### Example:

We choose the sample - Superstore data source and create a view with order date in the column shelf and profit in the rows shelf as shown in the following screenshot.



Next, drag the "order date" field to the filter shelf and choose Range of dates in the filter dialog box. Choose the dates as shown in the following screenshot.



Tableau - Book8

Data      Analytics      Pages      Columns      YEAR(Order Dat.)

Sample - Superstore

Dimensions      Measures

Filter [Order Date]

Relative dates      Range of dates      Starting date      Ending date      Special

Range of dates

3/27/2012      3/11/2013

1/4/2011      12/31/2014

Show: Only relevant values      Include Null Values

Reset      OK      Cancel      Apply

Top Customers by Profit

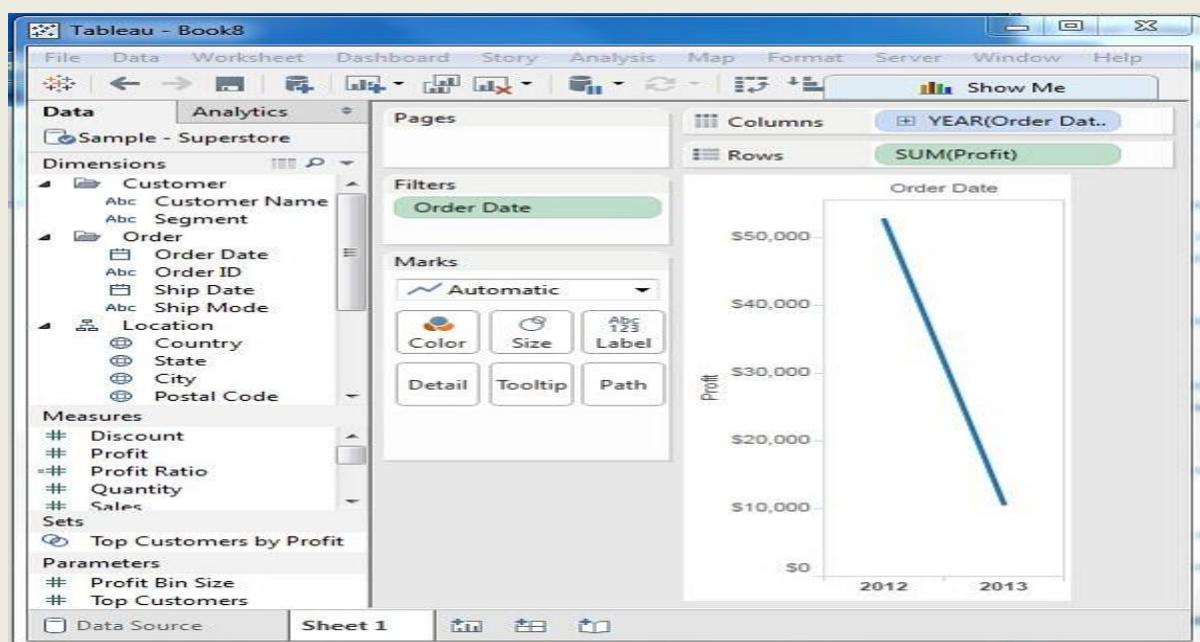
Profit Bin Size

Top Customers

Data Source      Sheet 1

On clicking OK, the final view appears showing the result for the chosen range of dates as seen in the following screenshot.

DV LAB





Many filter types in Tableau are quickly available using the right-click option on the dimension or measure. These filters known as Quick filters have enough functionality to solve most of the common filtering needs.

The following screenshot shows how the quick filters are accessed.

The screenshot displays the Tableau interface with the title bar "Tableau - Quick\_filters". The menu bar includes File, Data, Worksheet, Dashboard, Story, Analysis, Map, Format, Server, Window, and Help. Below the menu is a toolbar with various icons. The main workspace shows a data source with a single measure "SUM(Sales)" and a dimension "Sub-Category". In the "Filters" pane, "Sub-Category" is selected. A context menu is open over the "Copiers" item in the list, showing options like "Edit Filter...", "Remove Filter", "Apply to Worksheets", "Format Filters...", "Customize", "Show Title", "Edit Title...", and several filter type options: "Single Value (List)", "Single Value (Dropdown)", "Single Value (Slider)", "Multiple Values (List)", "Multiple Values (Dropdown)", "Multiple Values (Custom List)", "Wildcard Match", "Only relevant values", "All values in database", "Include Values", "Exclude Values", and "Hide Card". The "Multiple Values (List)" option is currently selected. The bottom of the workspace shows the "Data Source" tab, "Sheet 1" tab, and a data summary table with 17 rows and 17 columns.



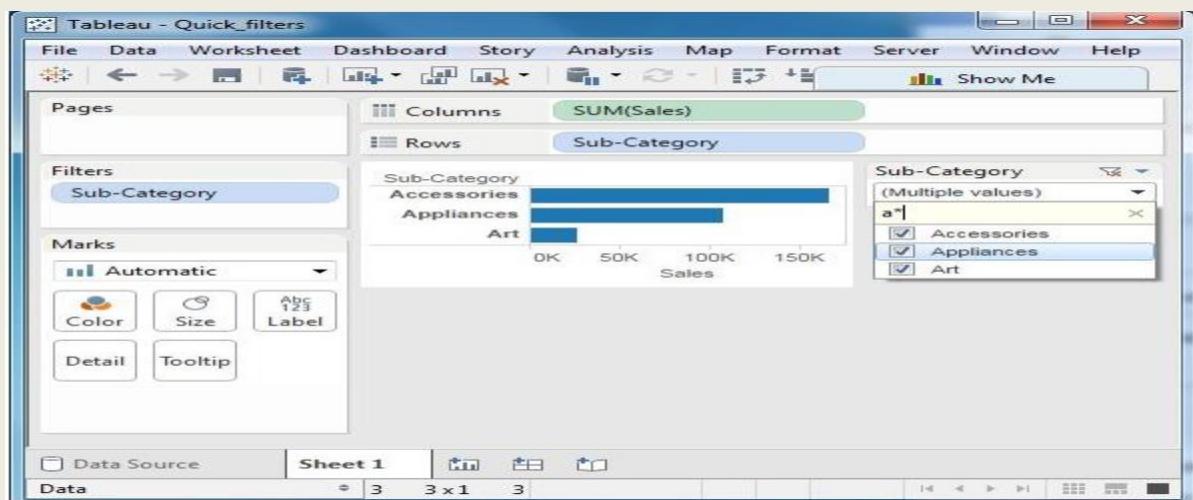
Following is a list of various quick filters and their use.

Filter name	Purpose
<b>Single Value (List)</b>	Select one value at a time in a list.
<b>Single Value (Dropdown)</b>	Select a single value in a drop-down list.
<b>Multiple Values (List)</b>	Select one or more values in a list.
<b>Multiple Values (Dropdown)</b>	Select one or more values in a drop-down list.
<b>Multiple Values (Custom List)</b>	Search and select one or more values.
<b>Single Value (Slider)</b>	Drag a horizontal slider to select a single value.
<b>Wildcard Match</b>	Select values containing the specified characters.

## Example

Consider the Sample-Superstore data source to apply some quick filters. In the following example, choose sub-category as the row and sales as the column which by default produces a horizontal bar chart. Next, drag the sub-category field to the filters pane. All the subcategories appear next to the chart. Apply wildcard filtering using the expression **a\*** which selects all subcategory name starting with “a”.

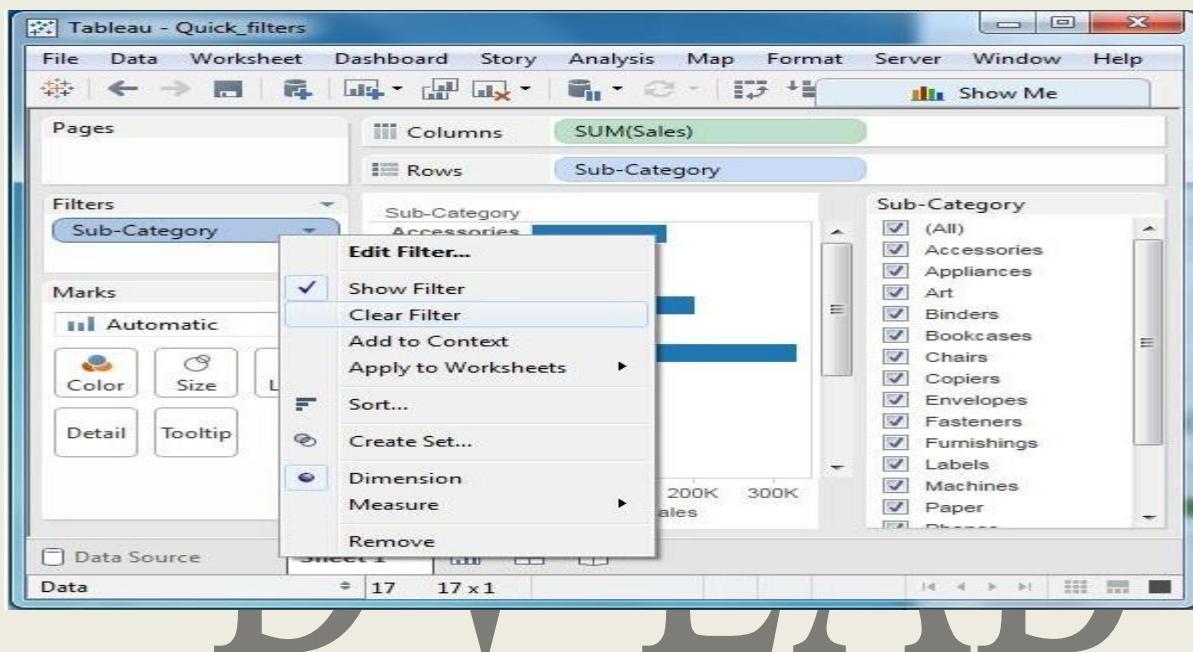
The below screen shows the result of applying this filter where only the sub-categories starting with “A” are displayed.





## Clearing the Filter

Once the analysis is complete by applying the filter, remove it by using the clear filter option. For this, go to the filter Pane, right-click on the field name and choose Clear Filter as shown in the following screenshot.



The normal filters in Tableau are independent of each other. It means each of the filter reads all the rows from the source data and creates its own result. However, there may be scenarios where you might want the second filter to process only the records returned by the first filter. In such a case, the second filter is known as dependent filters because they process only the data that passes through the context filter. Context Filters serve two main purposes.

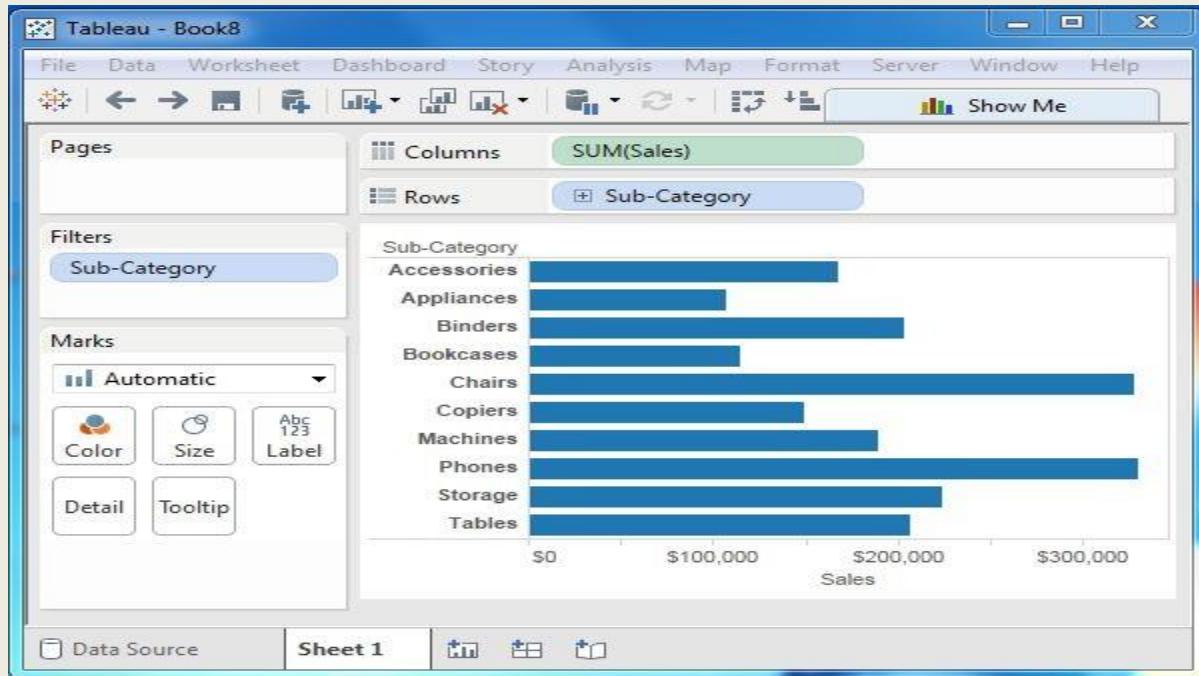
- **Improves performance** – If you set a lot of filters or have a large data source, the queries can be slow. You can set one or more context filters to improve the performance.
- **Creates a dependent numerical or top N filter** – You can set a context filter to include only the data of interest, and then set a numerical or a top N filter.

### Creating Context Filter

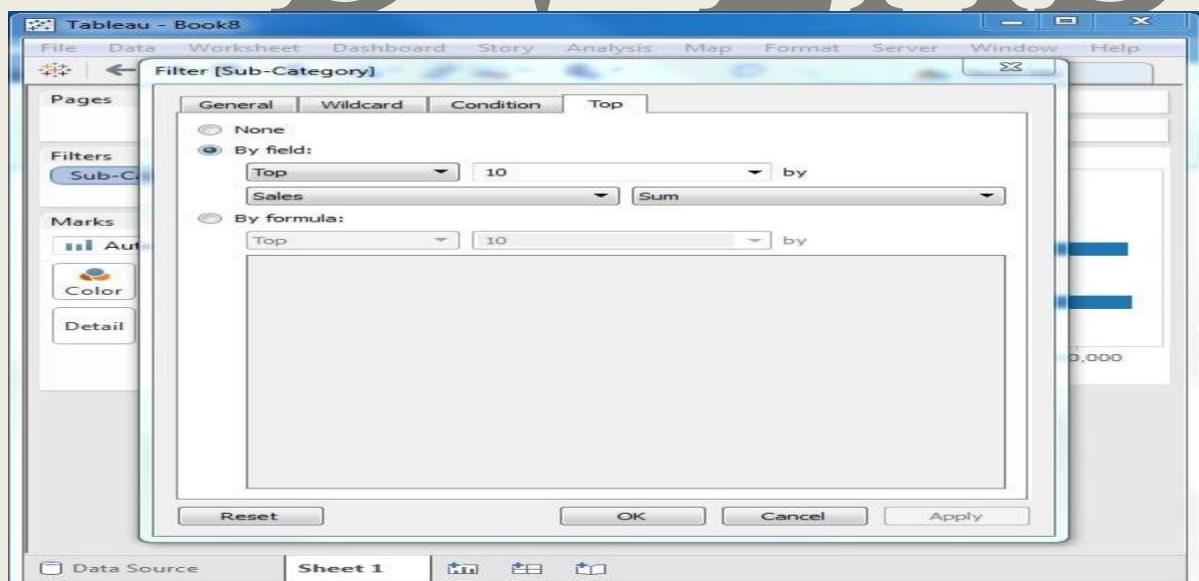
Using the Sample-superstore, find the top 10 Sub-Category of products for the category called Furniture. To achieve this objective, following are the steps.



**Step 1** – Drag the dimension Sub-Category to the Rows shelf and the measure Sales to the Columns Shelf. Choose the horizontal bar chart as the chart type. Drag the dimension Sub-Category again to the Filters shelf. You will get the following chart.

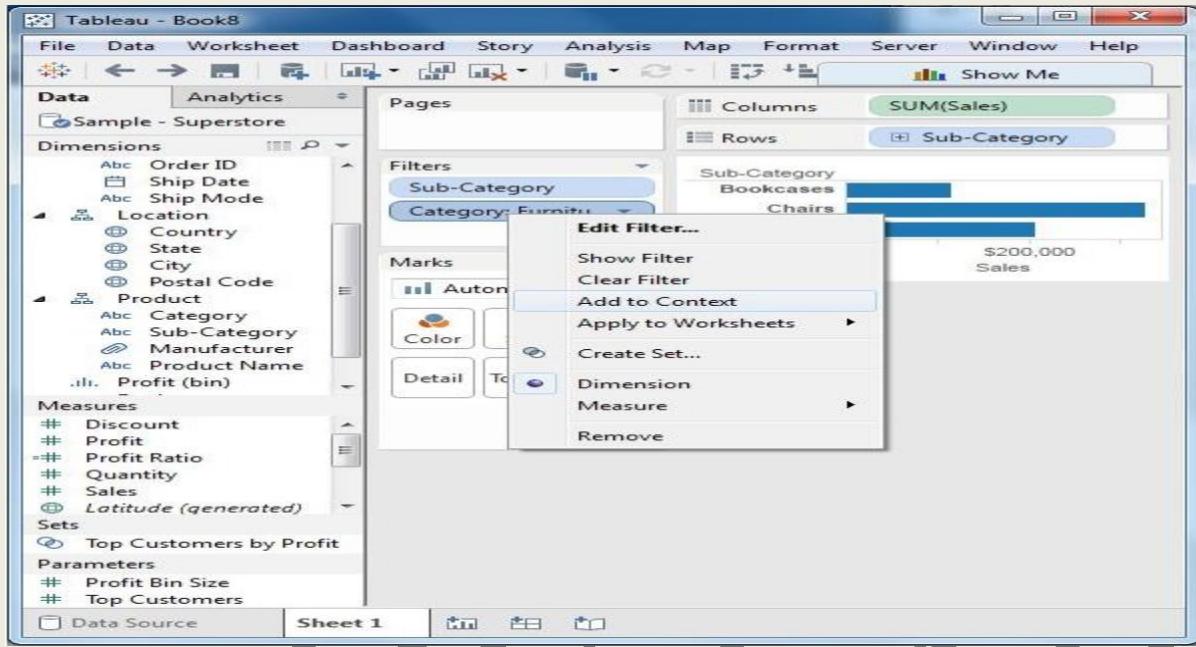


**Step 2** – Right-click on the field Sub-Category in the filter shelf and go the fourth tab named Top. Choose the option by field. From the next drop-down, choose the option Top 10 by Sales Sum as shown in the following screenshot.

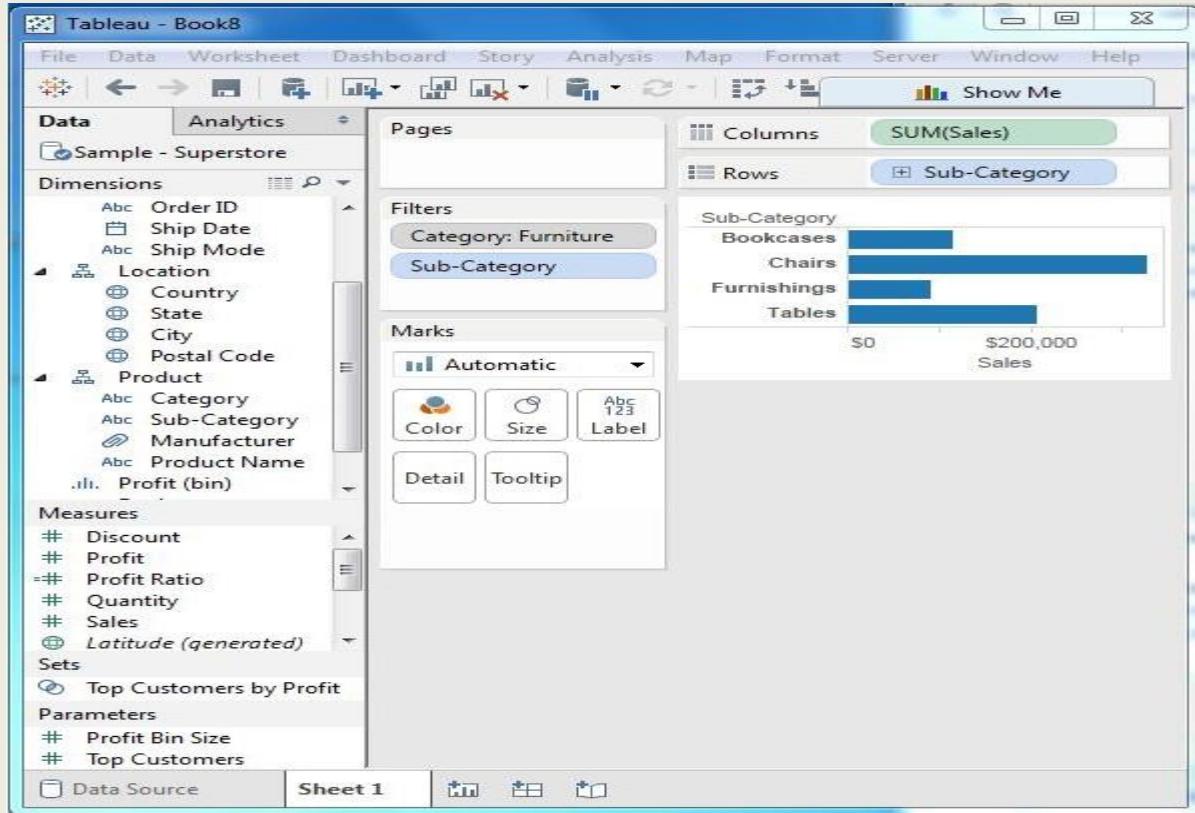




**Step 3 – Drag the dimension Category to the filter shelf. Right-click to edit and under the general tab choose Furniture from the list. As you can see the result shows three subcategory of products.**



**Step 4 – Right-click the Category: Furniture filter and select the option Add to Context. This produces the final result, which shows the subcategory of products from the category Furniture which are among the top 10 subcategories across all the products.**

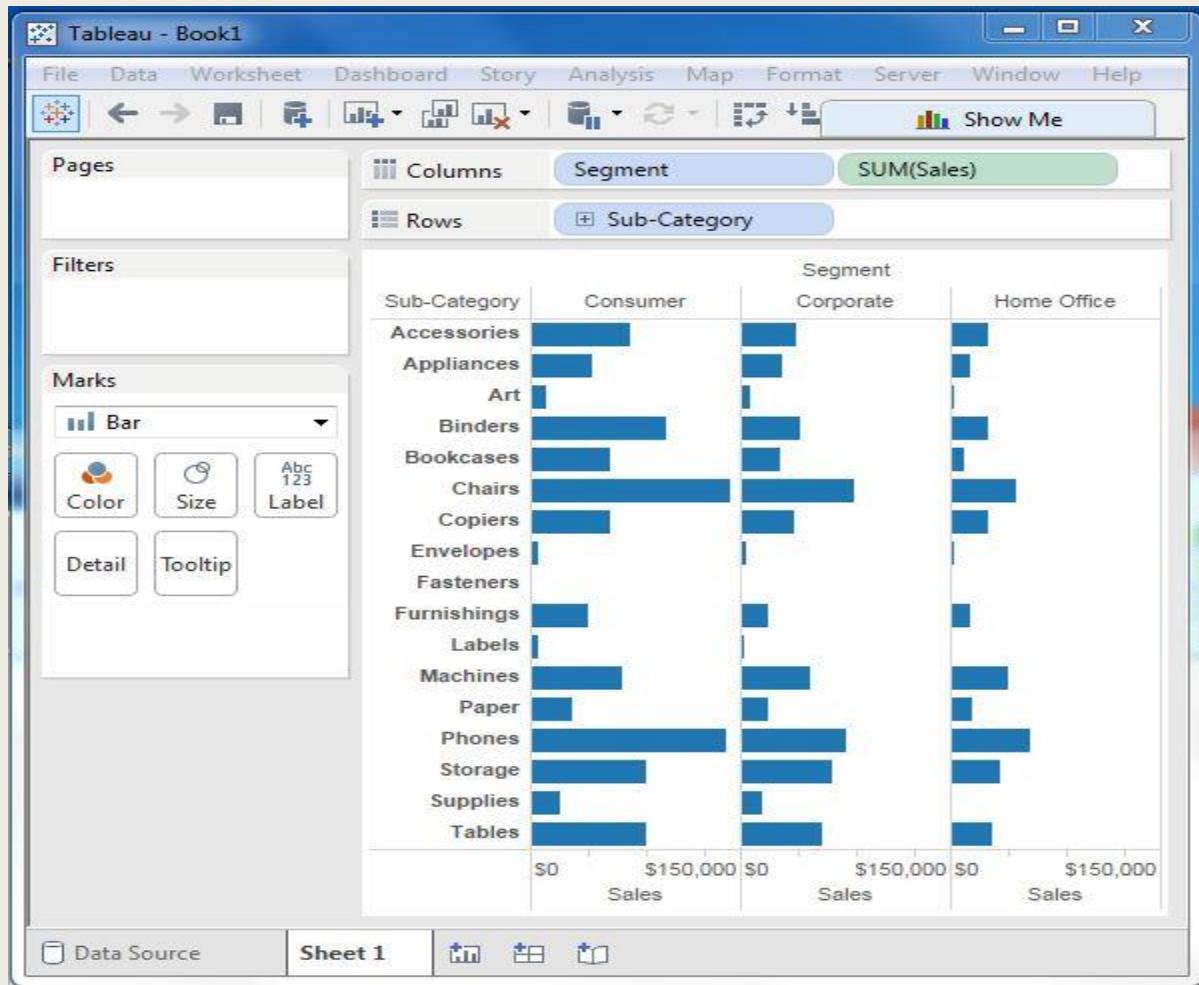


One of the important filtering options in Tableau is to apply some conditions to already existing filters. These conditions can be very simple like finding only those sales which are higher than a certain amount or it can be a complex one based on a certain formula. The conditions can also be applied to create a range filter.

## Creating a Condition Filter

Using the Sample-superstore, let's find that sub-category of products across all segments whose sales exceed one million. To achieve this objective, following are the steps.

**Step 1** – Drag the dimension segment and the measure Sales to the Column shelf. Next, drag the dimension Sub-Category to the Rows shelf. Choose the horizontal bar chart option. You will get the following chart.



**Step 2** – Drag the dimension Sub-Category to the Filters Shelf. Right-click to edit and go to the tab Condition. Here, choose the radio option by field. From the drop-down, select Sales, Sum and greater than equal to symbol specifying the value 100000.



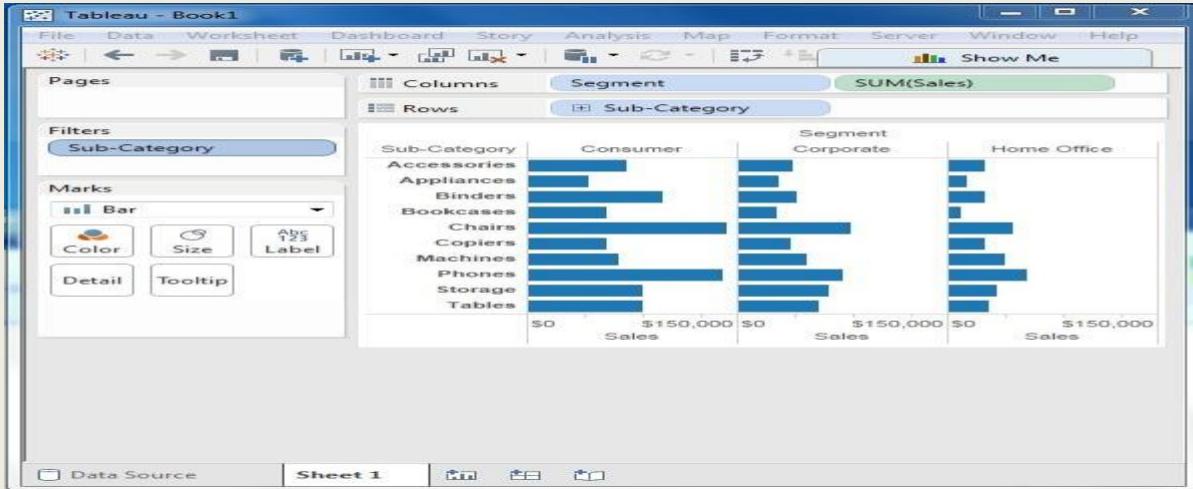
## TKR COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)

(Sponsored by TKR Educational Society , Approved by AICTE, Affiliated by JNTUH,  
Accredited by NBA & NAAC with 'A' Grade)



The screenshot shows the Tableau interface with a filter dialog open. The filter is set to 'Segment' and 'Sub-Category'. The 'Filters' pane on the left shows a selected 'Sub-Category' filter. The 'Marks' pane indicates a bar chart is selected. The filter dialog has tabs for General, Wildcard, Condition, and Top. The 'Condition' tab is active, showing a 'By field:' section for 'Sales' with a sum of 100,000 or more. There is also a 'Range of Values' section with fields for Min and Max, and a 'Load' button. The 'General' tab shows 'None' selected. The 'Top' tab is empty. At the bottom are buttons for Reset, OK, Cancel, and Apply.

On completion of the above two steps, we get a chart which shows only those subcategory of products, which have the required amount of sale. Also this is shown for all the available segments where the condition is met.

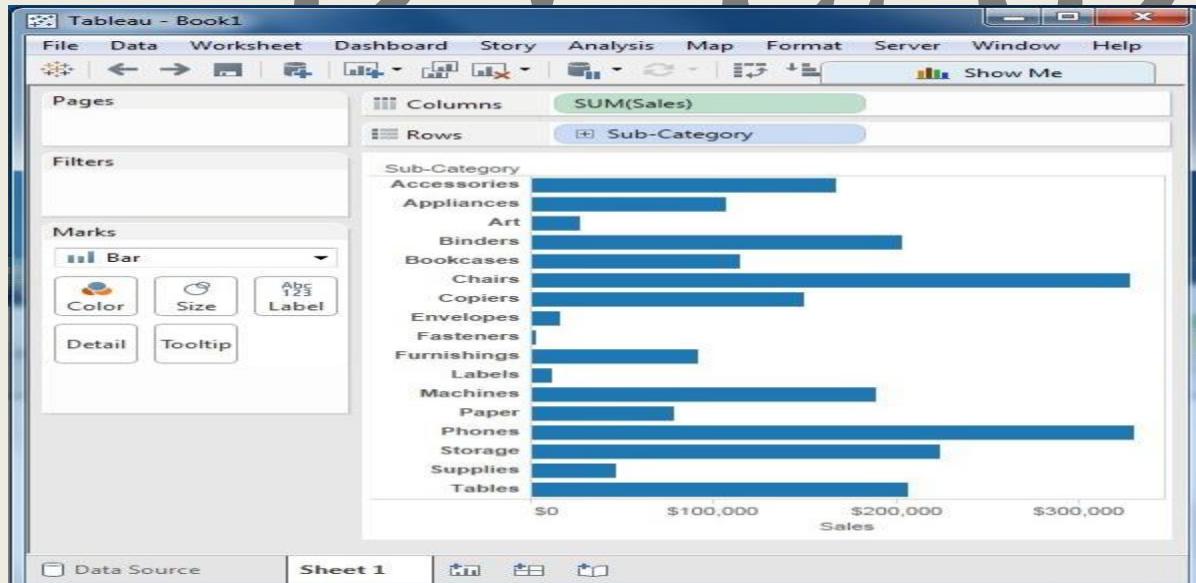


The Top option in Tableau filter is used to limit the result set from a filter. For example, from a large set of records on sales you want only the top 10 values. You can apply this filter using the inbuilt options for limiting the records in many ways or by creating a formula. In this chapter, you will explore the inbuilt options.

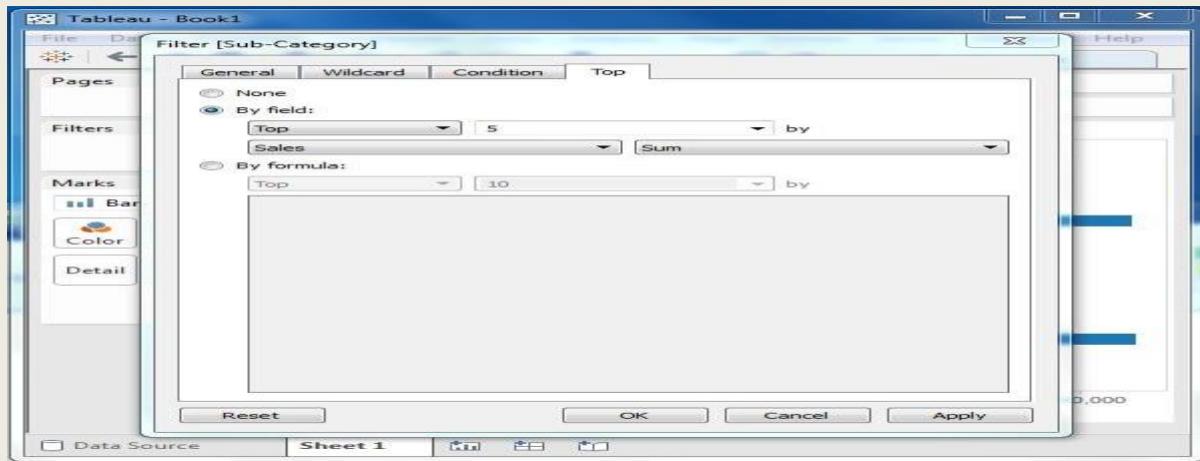
### Creating a Top Filter

Using the Sample-superstore, find the sub-category of products which represents the top 5 sales amount. To achieve this objective, following are the steps.

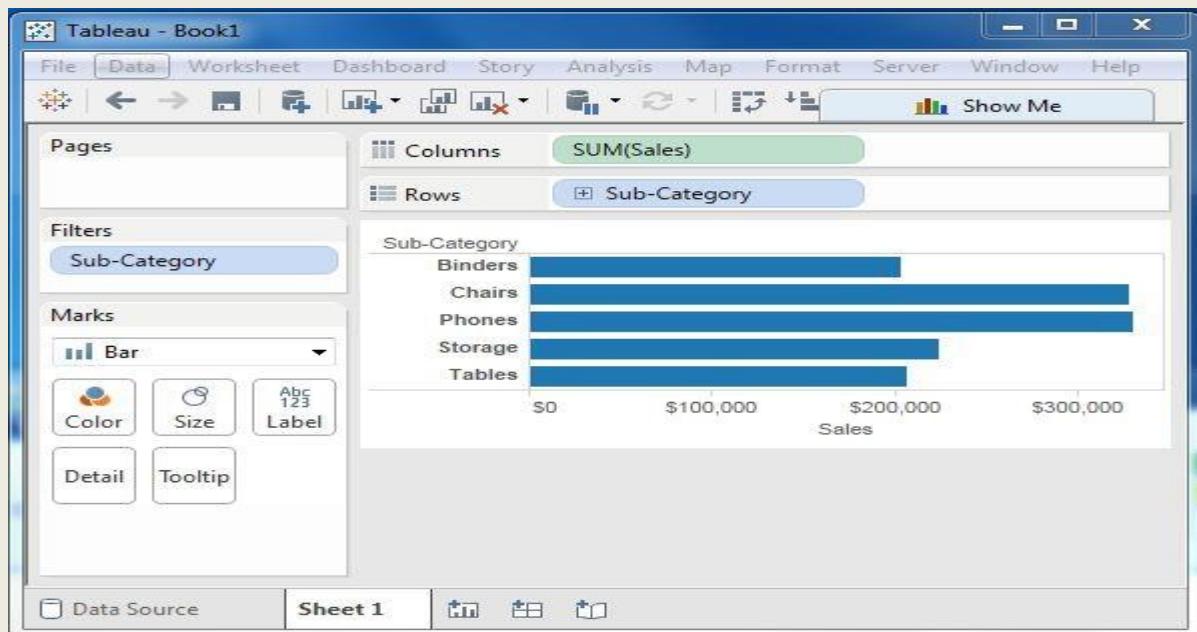
**Step 1** – Drag the dimension Sub-Category to the Rows shelf and the Measure Sales to the Columns shelf. Choose the horizontal bar as the chart type. Tableau shows the following chart.



**Step 2** – Right-click on the field Sub-Category and go to the tab named Top. Here, choose the second radio option by field. From the drop-down, choose the option Top 5 by Sum of Sales.



On completion of the above step, you will get the following chart, which shows the top 5 Sub-Category of products by sales.

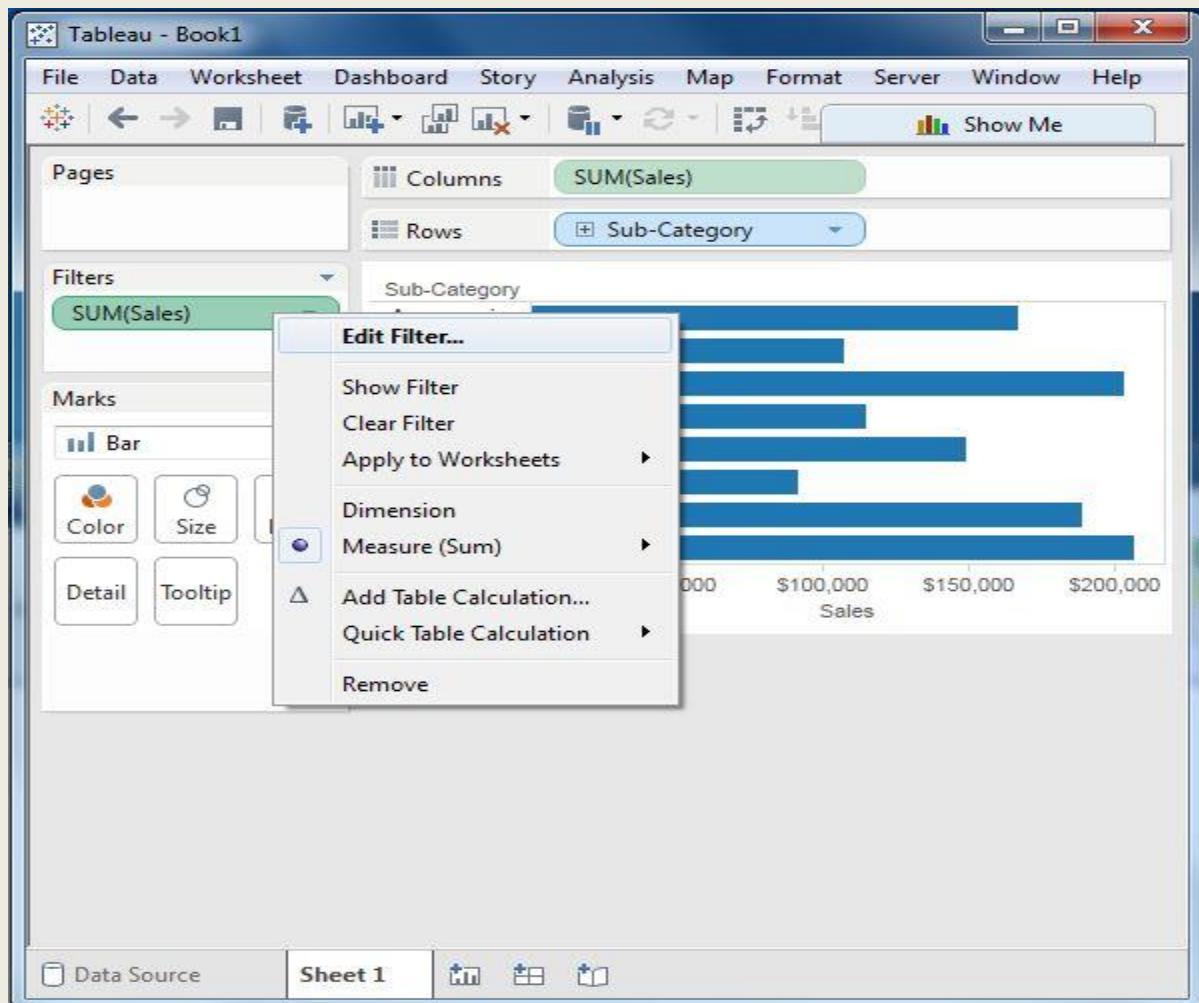


Any data analysis and visualization work involves the use of extensive filtering of data. Tableau has a very wide variety of filtering options to address these needs. There are many inbuilt functions for applying filters on the records using both dimensions and measures. The filter option for measures offers numeric calculations and comparison. The filter option for dimension offers choosing string values from a list or using a custom list of values. In this chapter, you will learn about the various options as well as the steps to edit and clear the filters.



## Creating Filters

Filters are created by dragging the required field to the Filters shelf located above the Marks card. Create a horizontal bar chart by dragging the measure sales to the Columns shelf and the dimension Sub-Category to the Rows shelf. Again drag the measure sales into the Filters shelf. Once this filter is created, right-click and choose the edit filter option from the pop-up menu.



## Creating Filters for Measures

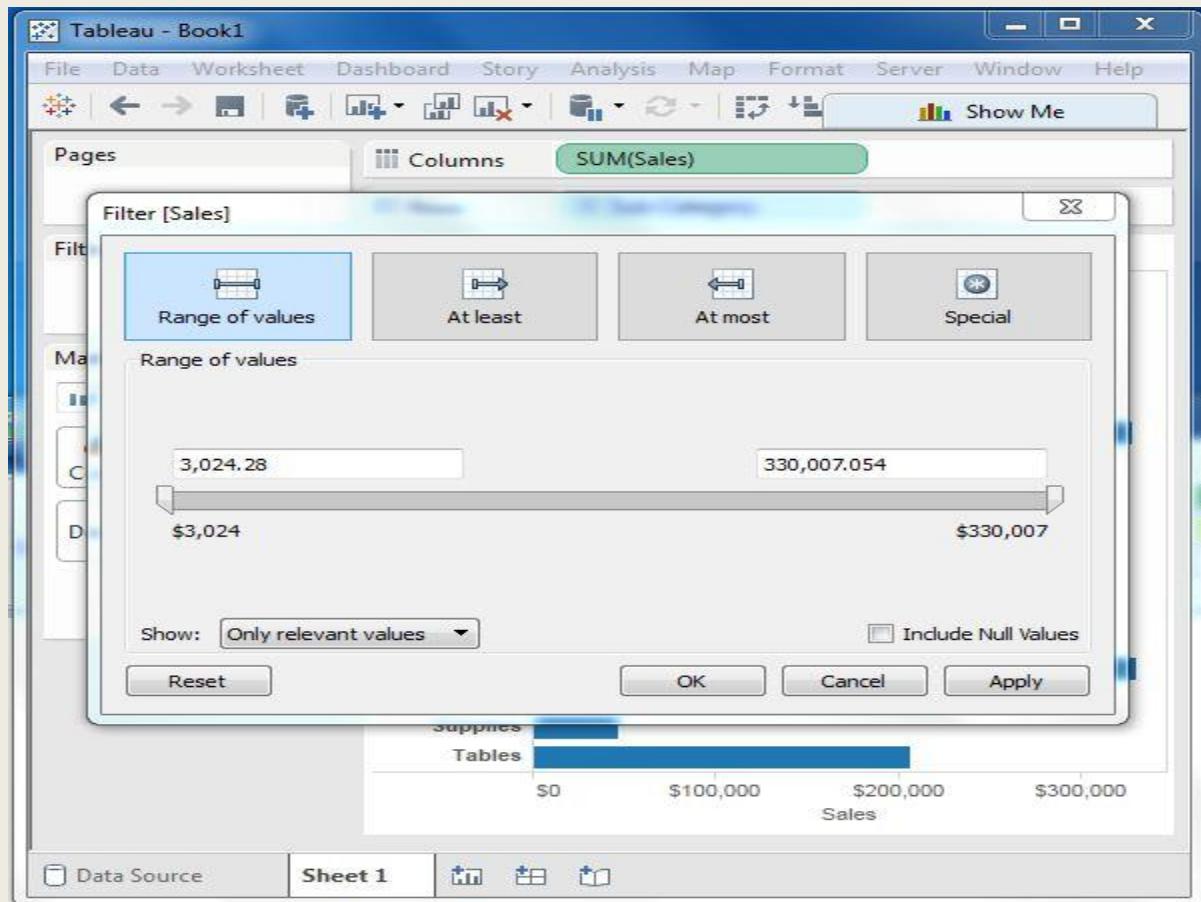
Measures are numeric fields. So, the filter options for such fields involve choosing values. Tableau offers the following types of filters for measures.

- **Range of Values** – Specifies the minimum and maximum values of the range to include in the view.
- **At Least** – Includes all values that are greater than or equal to a specified minimum value.



- **At Most** – Includes all values that are less than or equal to a specified maximum value.
- **Special** – Helps you filter on Null values. Include only Null values, Non-null values, or All Values.

Following worksheet shows these options.



## Creating Filters for Dimensions

Dimensions are descriptive fields having values which are strings. Tableau offers the following types of filters for dimensions.

- **General Filter** – allows to select specific values from a list.
- **Wildcard Filter** – allows to mention wildcards like **cha\*** to filter all string values starting with **cha**.
- **Condition Filter** – applies conditions such as sum of sales.
- **Top Filter** – chooses the records representing a range of top values.



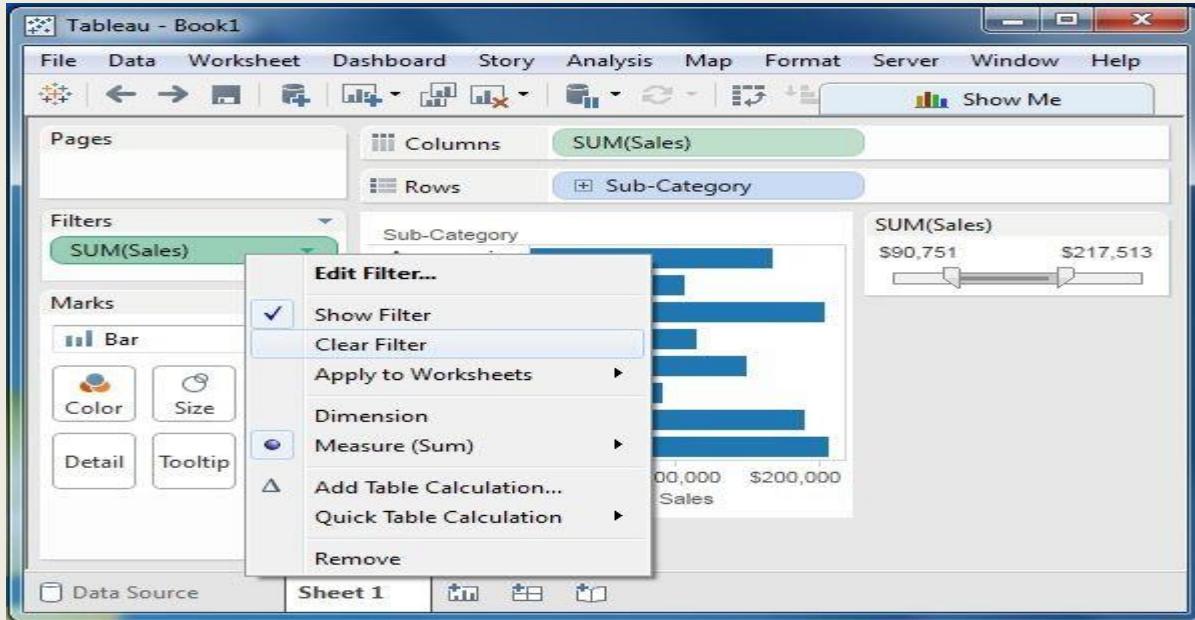
Following worksheet shows these options.

The screenshot shows the Tableau interface with a filter dialog box open. The dialog is titled "Filter [Sub-Category]" and contains a list of sub-categories: Accessories, Appliances, Art, Binders, Bookcases, Chairs, Copiers, Envelopes, Fasteners, Furnishings, and Labels. All items in the list have checkboxes checked. Below the list are buttons for "All", "None", and "Exclude". At the bottom of the dialog is a "Summary" section with the following details:  
Field: [Sub-Category]  
Selection: Selected 17 of 17 values  
Wildcard: All  
Condition: None  
Limit: None  
Buttons at the bottom of the dialog include "Reset", "OK", "Cancel", and "Apply".

## Clearing Filters

DV LAD

Filters can be easily removed by choosing the clear filter option as shown in the following screenshot.



## PROGRAM 7:

**AIM :Construction of Charts (Line, BAR, etc.).**

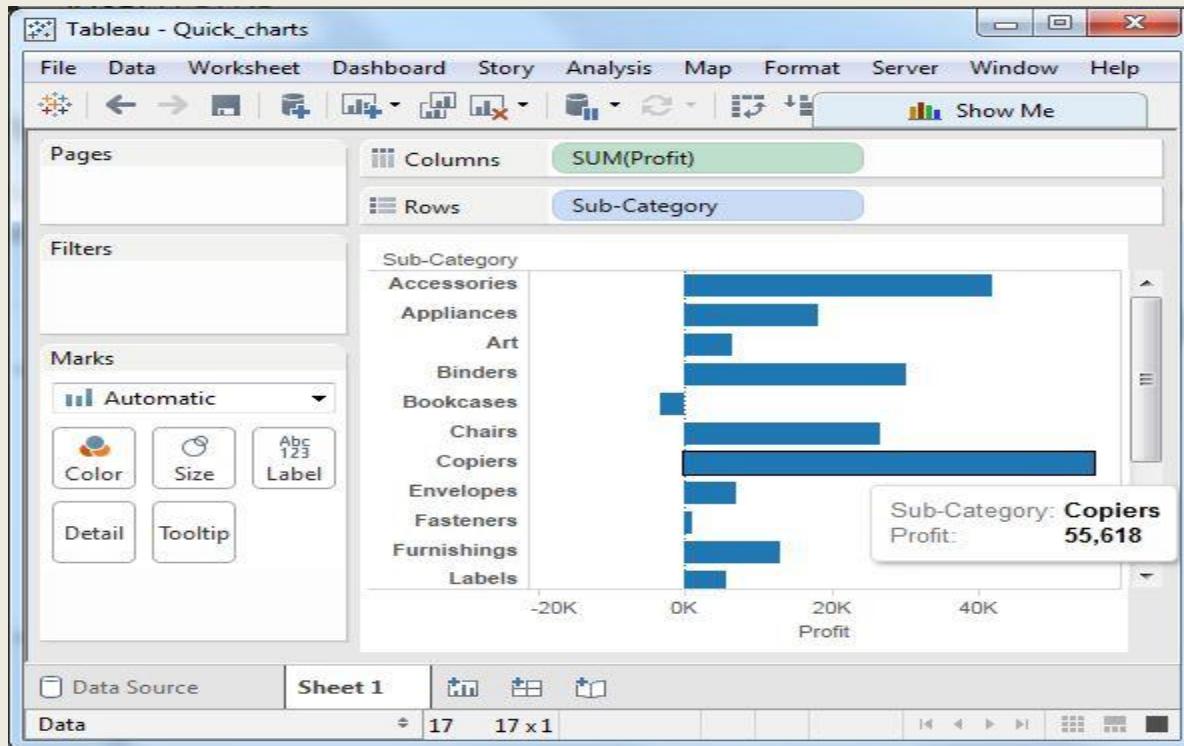
**Explanation:**

DV LAB

A bar chart represents data in rectangular bars with the length of the bar proportional to the value of the variable. Tableau automatically produces a bar chart when you drag a dimension to the Row shelf and measure to the Column shelf. We can also use the bar chart option present in the Show Me button. If the data is not appropriate for bar chart, then this option will be automatically greyed out. In Tableau, various types of bar charts can be created by using a dimension and a measure.

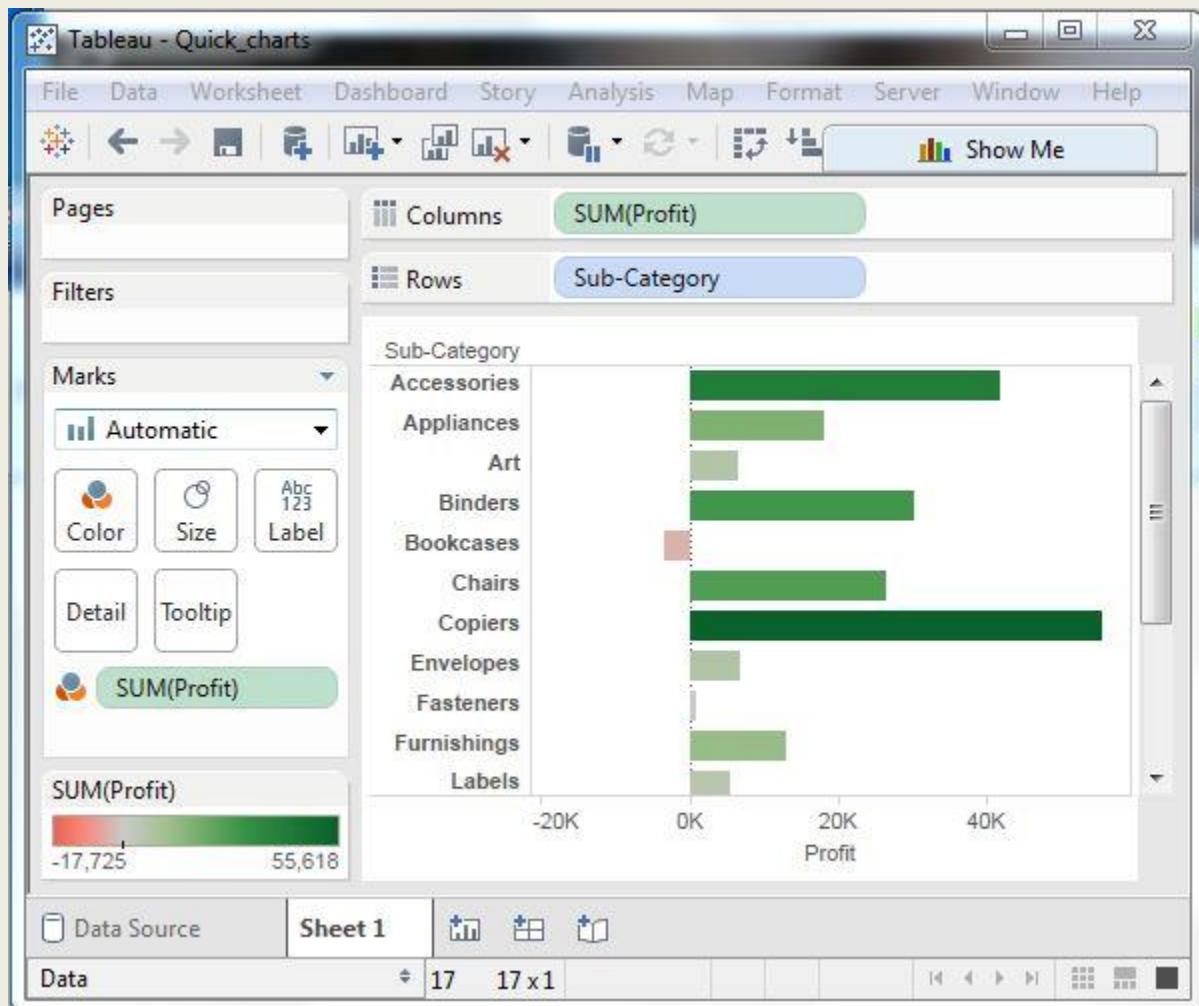
### Simple Bar Chart

From the Sample-Superstore, choose the dimension, take profit to the columns shelf and Sub-Category to the rows shelf. It automatically produces a horizontal bar chart as shown in the following screenshot. In case, it does not, you can choose the chart type from the Show Me tool to get the following result.



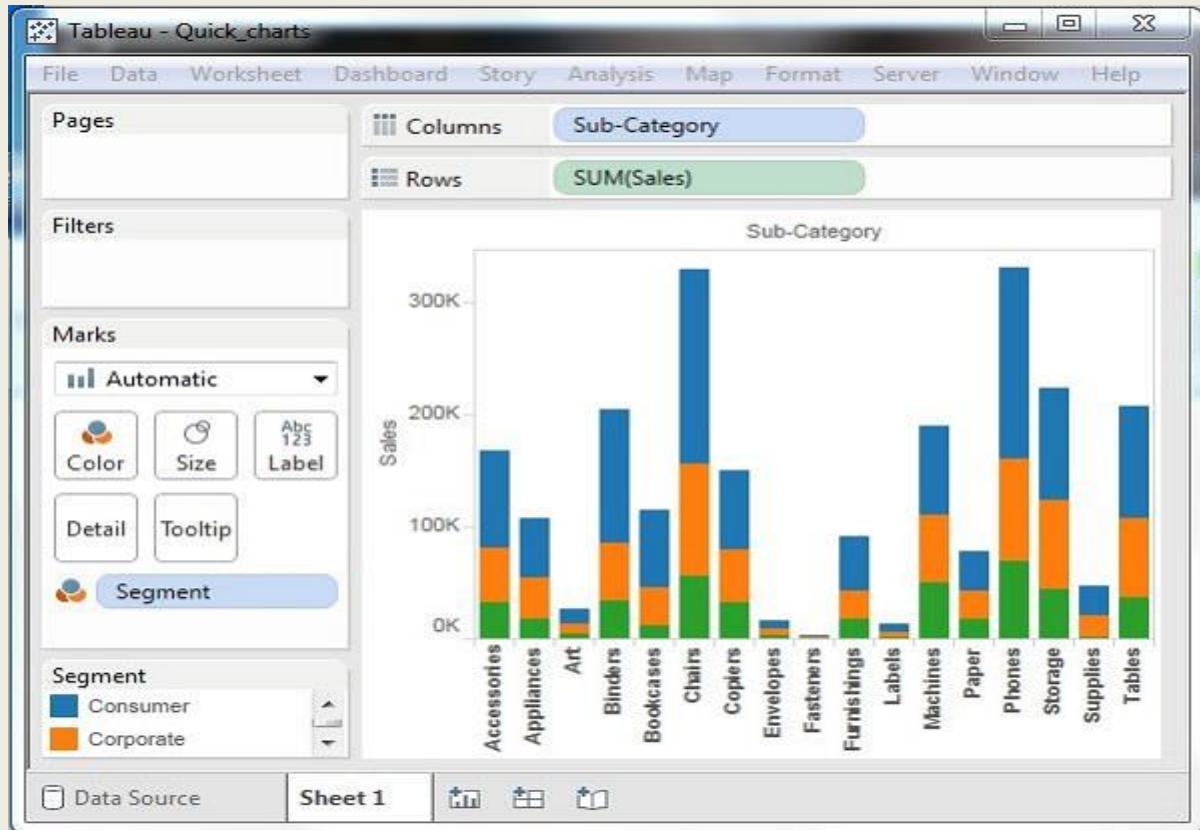
## Bar Chart with Color Range

we can apply colors to the bars based on their ranges. The longer bars get darker shades and the smaller bars get the lighter shades. To do this, drag the profit field to the color palette under the Marks Pane. Also note that, it produces a different color for negative bars.



## Stacked Bar Chart

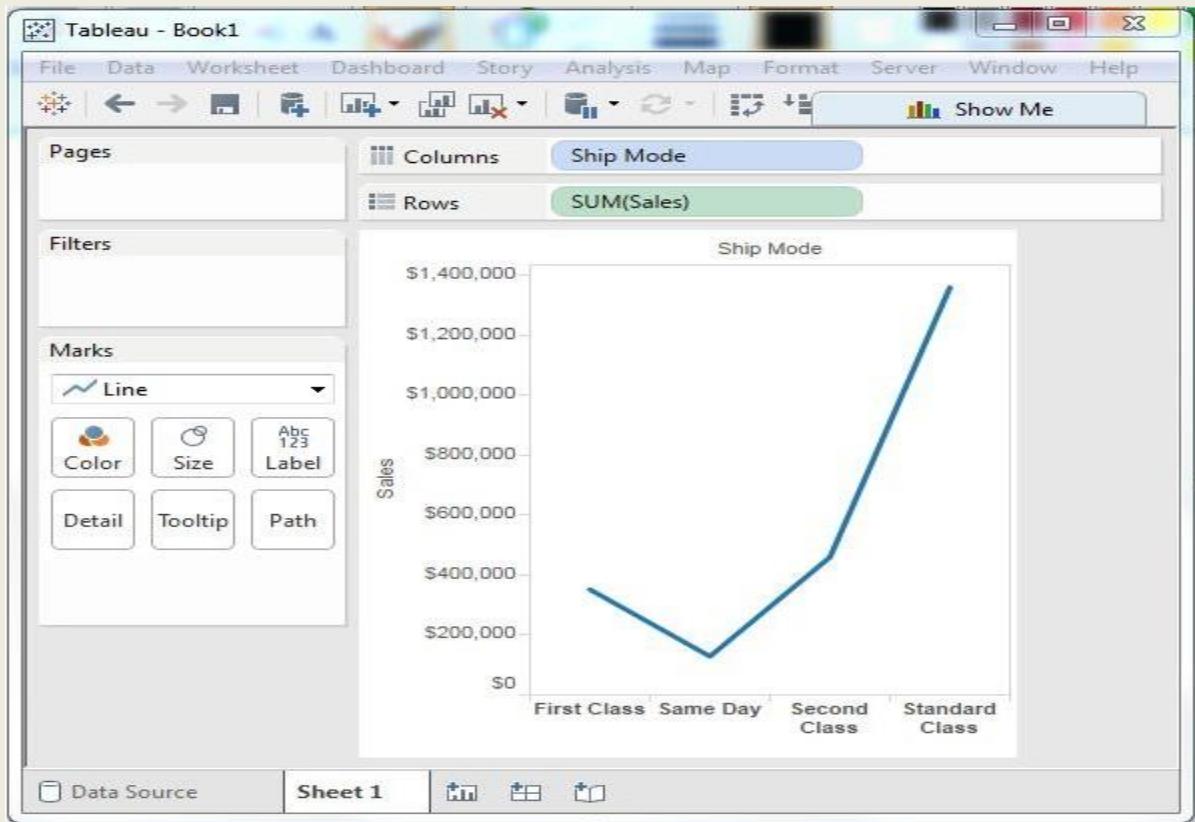
We can add another dimension to the above bar chart to produce a stacked bar chart, which shows different colors in each bar. Drag the dimension field named segment to the Marks pane and drop it in colors. The following chart appears which shows the distribution of each segment in each bar.



In a line chart, a **measure** and a dimension are taken along the two axes of the chart area. The pair of values for each observation becomes a point and the joining of all these points create a line showing the variation or relationship between the dimensions and measures chosen.

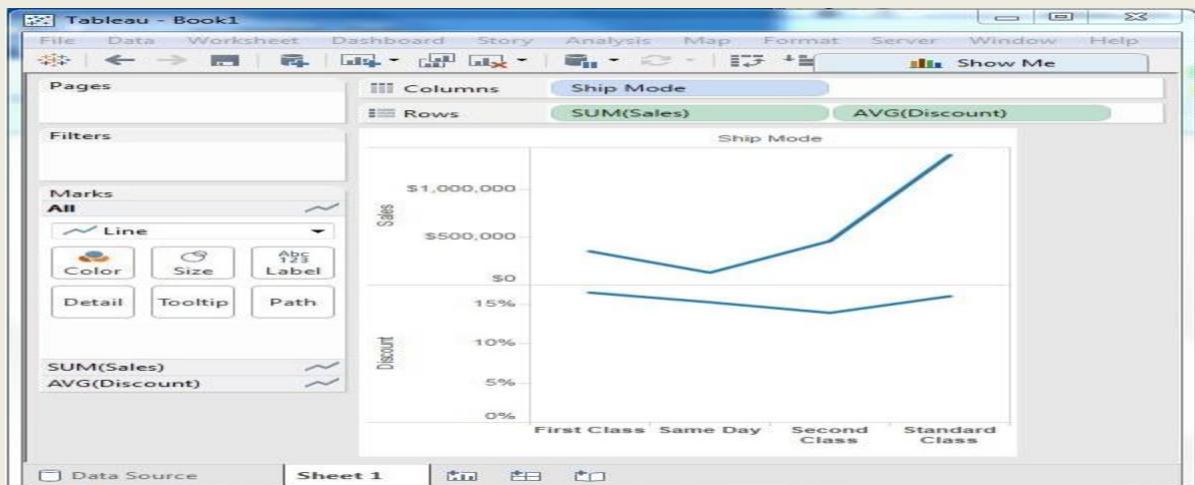
### Simple Line Chart

Choose one dimension and one measure to create a simple line chart. Drag the dimension Ship Mode to Columns Shelf and Sales to the Rows shelf. Choose the Line chart from the Marks card. You will get the following line chart, which shows the variation of Sales for different Ship modes.



## Multiple Measure Line Chart

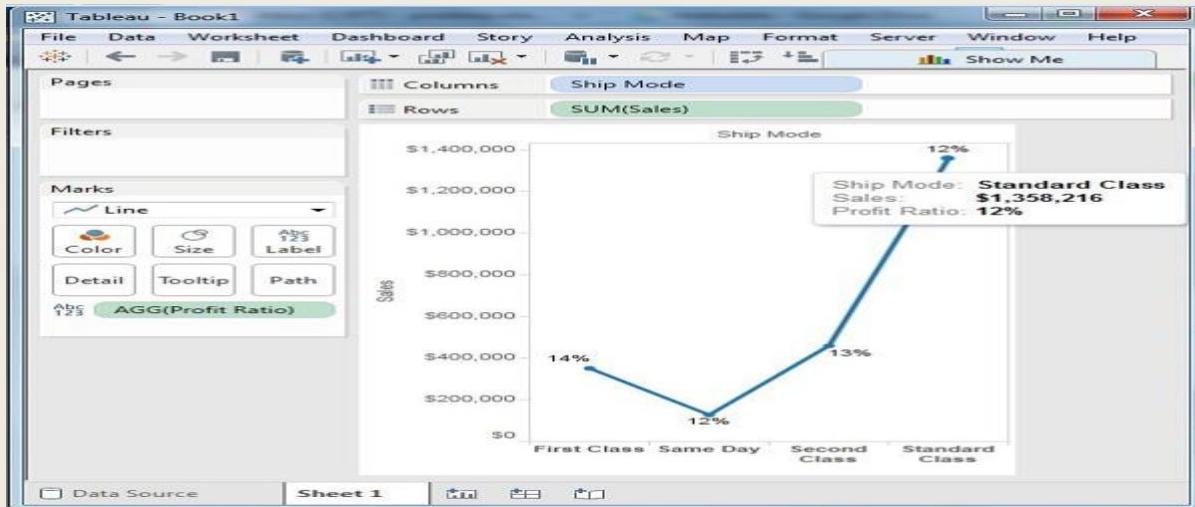
You can use one dimension with two or more measures in a line chart. This will produce multiple line charts, each in one pane. Each pane represents the variation of the dimension with one of the measures.





## Line Chart with Label

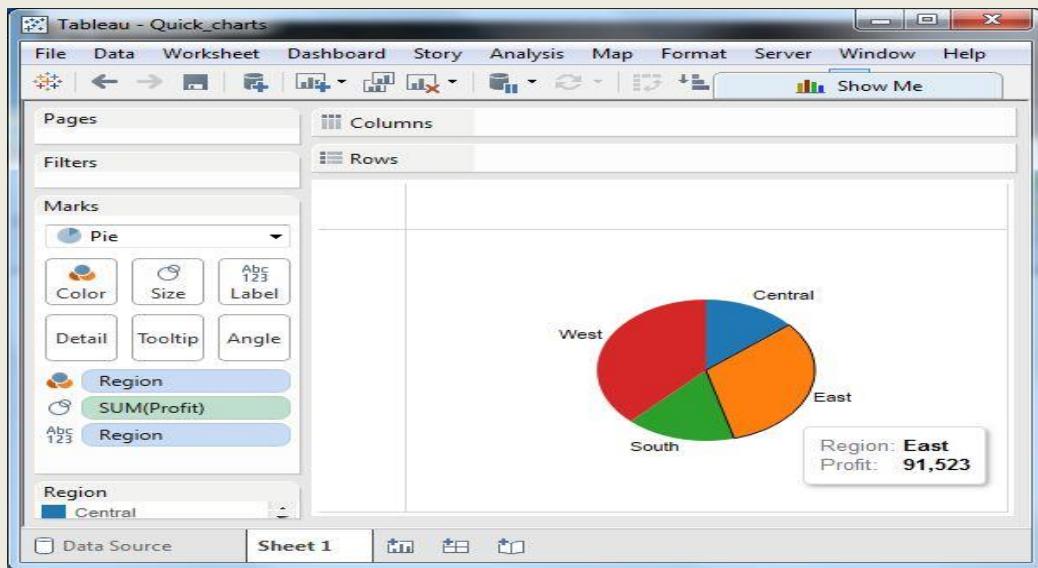
Each of the points making the line chart can be labeled to make the values of the measure visible. In this case, drop another measure Profit Ratio into the labels pane in the Marks card. Choose average as the aggregation and you will get the following chart showing the labels.



A pie chart represents data as slices of a circle with different sizes and colors. The slices are labeled and the numbers corresponding to each slice is also represented in the chart. You can select the pie chart option from the Marks card to create a pie chart.

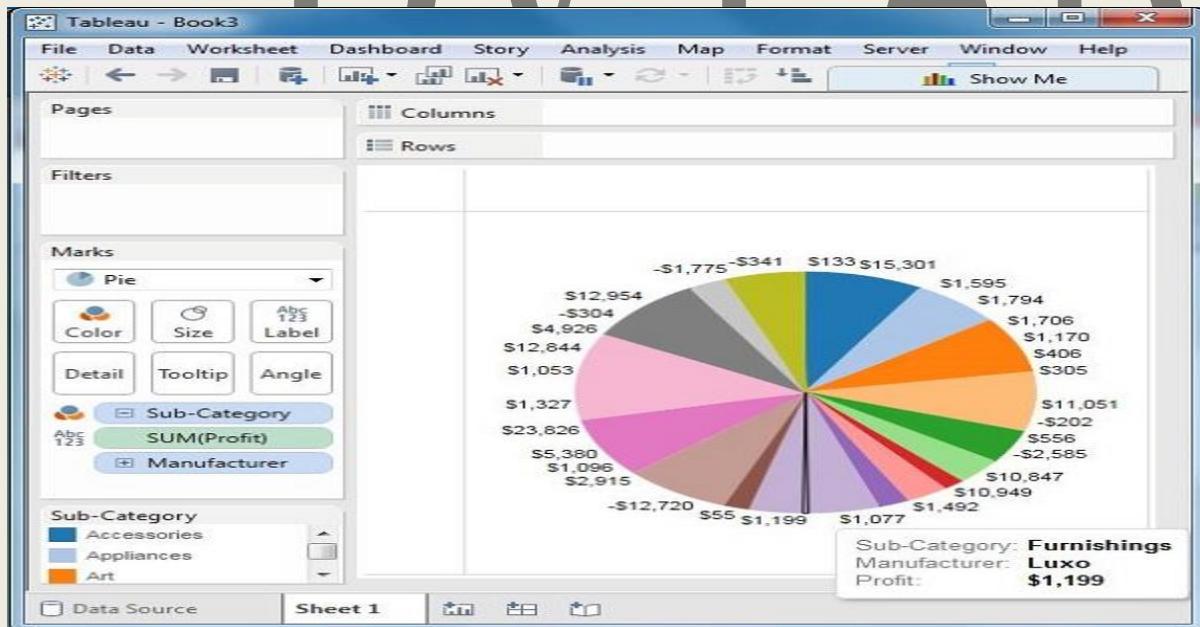
## Simple Pie Chart

Choose one dimension and one measure to create a simple pie chart. For example, take the dimension named region with the measure named profit. Drop the Region dimension in the colors and label marks. Drop the Profit measure into the size mark. Choose the chart type as Pie. The following chart appears which shows the 4 regions in different colors.

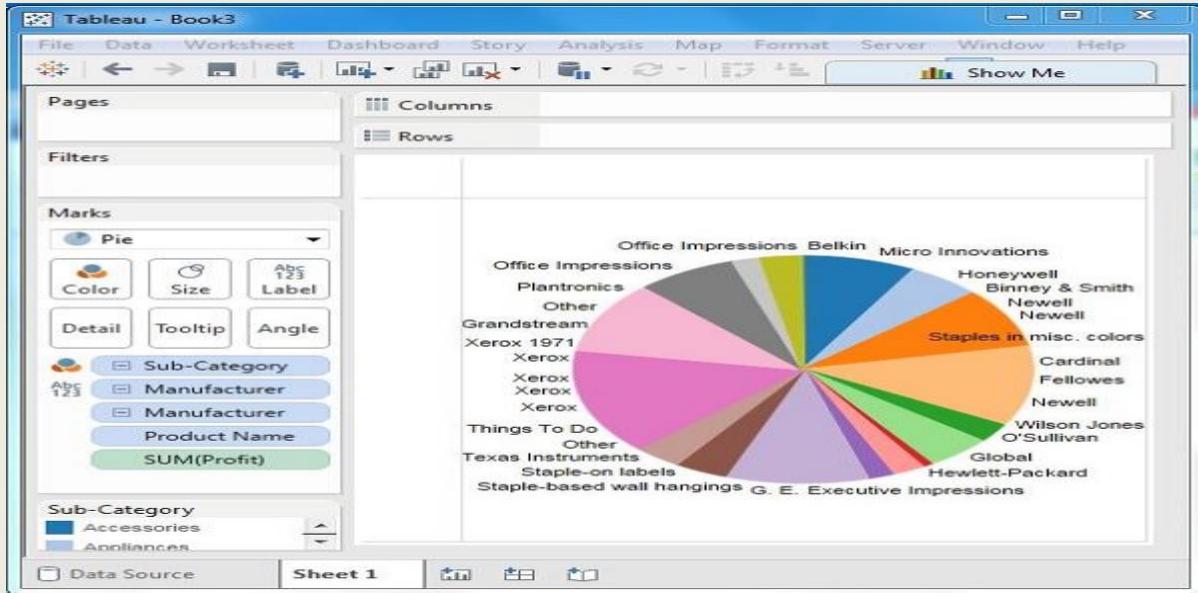


## Drill-Down Pie Chart

We can choose a dimension with hierarchy and as you go deeper into the hierarchy, the chart changes reflect the level of the dimension chosen. In the following example, we take the dimension Sub-Category which has two more levels - Manufacturer and Product Name. Take the measure profit and drop it to the Labels mark. The following pie chart appears which shows the values for each slice.



Going one more level into the hierarchy, we get the manufacturer as the label and the above pie chart changes to the following one.



A crosstab chart in Tableau is also called a Text table, which shows the data in textual form. The chart is made up of one or more dimensions and one or more measures. This chart can also show various calculations on the values of the measure field such as running total, percentage total, etc.

### Simple Crosstab

Using the Sample-superstore, let's plan to get the amount of sales for each segment in each region. You need to display this data for each year using the order dates available. To achieve this objective, following are the steps.

**Step 1** – Drag and drop the dimension order date to the columns shelf.

**Step 2** – Drag and drop the dimensions region and segment to the rows shelf.

**Step 3** – Pull the measure Sales to the labels Shelf under Marks.

The following chart appears which shows the Crosstab.



Tableau - Book3

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

Show Me

Pages

Columns YEAR(Order Date)

Rows Region Segment

Marks

Abc Automatic

Color Size Text

Detail Tooltip

Abc 123 SUM(Sales)

		Order Date			
Region	Segment	2011	2012	2013	2014
Central	Consumer	\$67,316	\$49,662	\$66,707	\$68,346
	Corporate	\$19,902	\$29,080	\$60,714	\$48,300
	Home Office	\$16,620	\$24,132	\$20,008	\$30,452
East	Consumer	\$76,504	\$85,033	\$93,761	\$95,610
	Corporate	\$37,640	\$44,717	\$53,295	\$64,757
	Home Office	\$14,537	\$26,582	\$33,473	\$52,873
South	Consumer	\$32,311	\$49,206	\$53,033	\$61,031
	Corporate	\$34,685	\$18,107	\$26,695	\$42,399
	Home Office	\$36,850	\$4,046	\$13,811	\$19,547
West	Consumer	\$89,966	\$82,634	\$82,794	\$107,487
	Corporate	\$36,208	\$36,853	\$66,239	\$86,555
	Home Office	\$21,709	\$20,479	\$37,943	\$56,591

Data Source Sheet 1

## Crosstab - Color Encoded

We can get the values color encoded in the crosstab chart by dropping the measure field into the Color shelf as shown in the following screenshot.

This color coding shows the strength of the color depending on the value of the measure. The larger values have a darker shade than the lighter values.



Tableau - Book3

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

Show Me

Pages

Columns YEAR(Order Date)

Rows Region Segment

Marks

Abc Automatic

Color Size Abc 123 Text

Detail Tooltip

SUM(Sales) SUM(Sales)

Abc 123 SUM(Sales)

SUM(Sales)

\$4,046 \$107,487

Order Date

Region	Segment	2011	2012	2013	2014
Central	Consumer	\$67,316	\$49,662	\$66,707	\$68,346
	Corporate	\$19,902	\$29,080	\$60,714	\$48,300
	Home Office	\$16,620	\$24,132	\$20,008	\$30,452
East	Consumer	\$76,504	\$85,033	\$93,761	\$95,610
	Corporate	\$37,640	\$44,717	\$53,295	\$64,757
	Home Office	\$14,537	\$26,582	\$33,473	\$52,873
South	Consumer	\$32,311	\$49,206	\$53,033	\$61,031
	Corporate	\$34,685	\$18,107	\$26,695	\$42,399
	Home Office	\$36,850	\$4,046	\$13,811	\$19,547
West	Consumer	\$89,966	\$82,634	\$82,794	\$107,487
	Corporate	\$36,208	\$36,853	\$66,239	\$86,555
	Home Office	\$21,709	\$20,479	\$37,943	\$56,591

Data Source Sheet 1

## Crosstab with Row Percentage

In addition to the color encoding, you can also get calculations applied to the values from the measure. In the following example, we apply the calculation for finding the percentage total of sales in each row instead of only the sales figures. For this, right-click on SUM (Sales) present in the marks card and choose the option Add Table Calculation. Then, choose the percent of total and summarize it as Table (Across).



Tableau - Book3

File Data Worksheet

Pages

Filters

Marks

Abc Automatic

Color Size

Detail Tooltip

SUM(Sales)

SUM(Sales)

SUM(Sales)

\$4,046 \$107,487

Filter... Show Filter Format... Dimension Attribute Measure (Sum) ▶ Discrete Continuous Edit in Shelf Compute using △ Edit Table Calculation... Clear Table Calculation Quick Table Calculation Remove

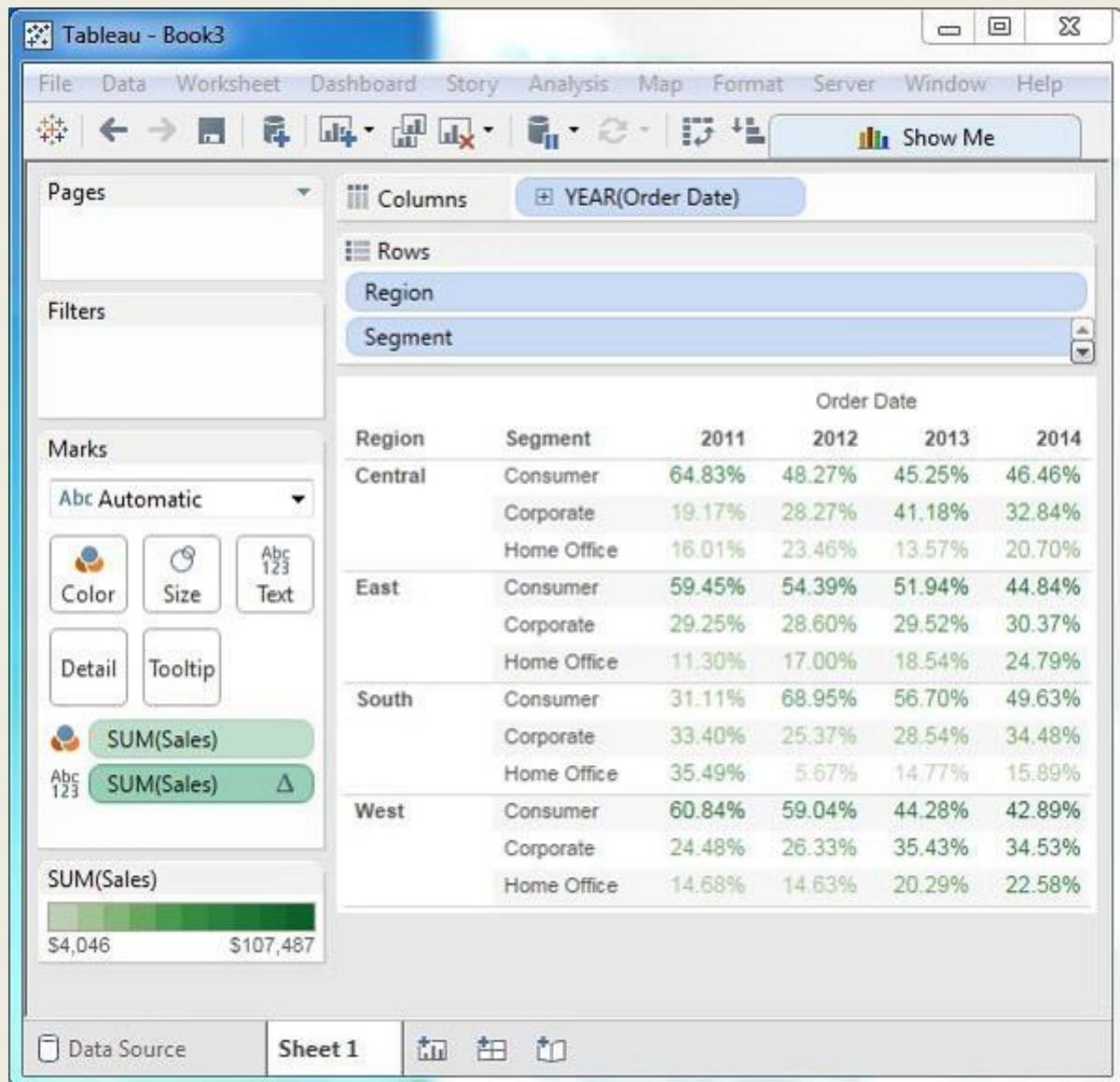
Order Date

	2011	2012	2013	2014
64.83%	48.27%	45.25%	46.46%	
19.17%	28.27%	41.18%	32.84%	
16.01%	23.46%	13.57%	20.70%	
59.45%	54.39%	51.94%	44.84%	
29.25%	28.60%	29.52%	30.37%	
11.30%	17.00%	18.54%	24.79%	
31.11%	68.95%	56.70%	49.63%	
33.40%	25.37%	28.54%	34.48%	
35.49%	5.67%	14.77%	15.89%	
West	Consumer	60.84%	59.04%	44.28%
	Corporate	24.48%	26.33%	35.43%
	Home Office	14.68%	14.63%	20.29%
				22.58%

Data Source Sheet 1

The screenshot shows the Tableau interface with a context menu open over the 'SUM(Sales)' measure in the Marks shelf. The menu includes options like Filter..., Show Filter, Format..., Dimension, Attribute, Measure (Sum), Discrete, Continuous, Edit in Shelf, Compute using, Edit Table Calculation..., Clear Table Calculation, Quick Table Calculation, and Remove. The 'Measure (Sum)' option is currently selected. The main workspace displays a crosstab chart with data from the 'Order Date' dimension and various measures.

On clicking OK in the screen above, you will find the crosstab chart created with percentage values as shown in the following screenshot.



As the name suggests, a scatter plot shows many points scattered in the Cartesian plane. It is created by plotting values of numerical variables as X and Y coordinates in the Cartesian plane. Tableau takes at least one measure in the Rows shelf and one measure in the Columns shelf to create a scatter plot. However, we can add dimension fields to the scatter plot which play a role in marking different colors for the already existing points in the scatter graph.

## Simple Scatter Plot



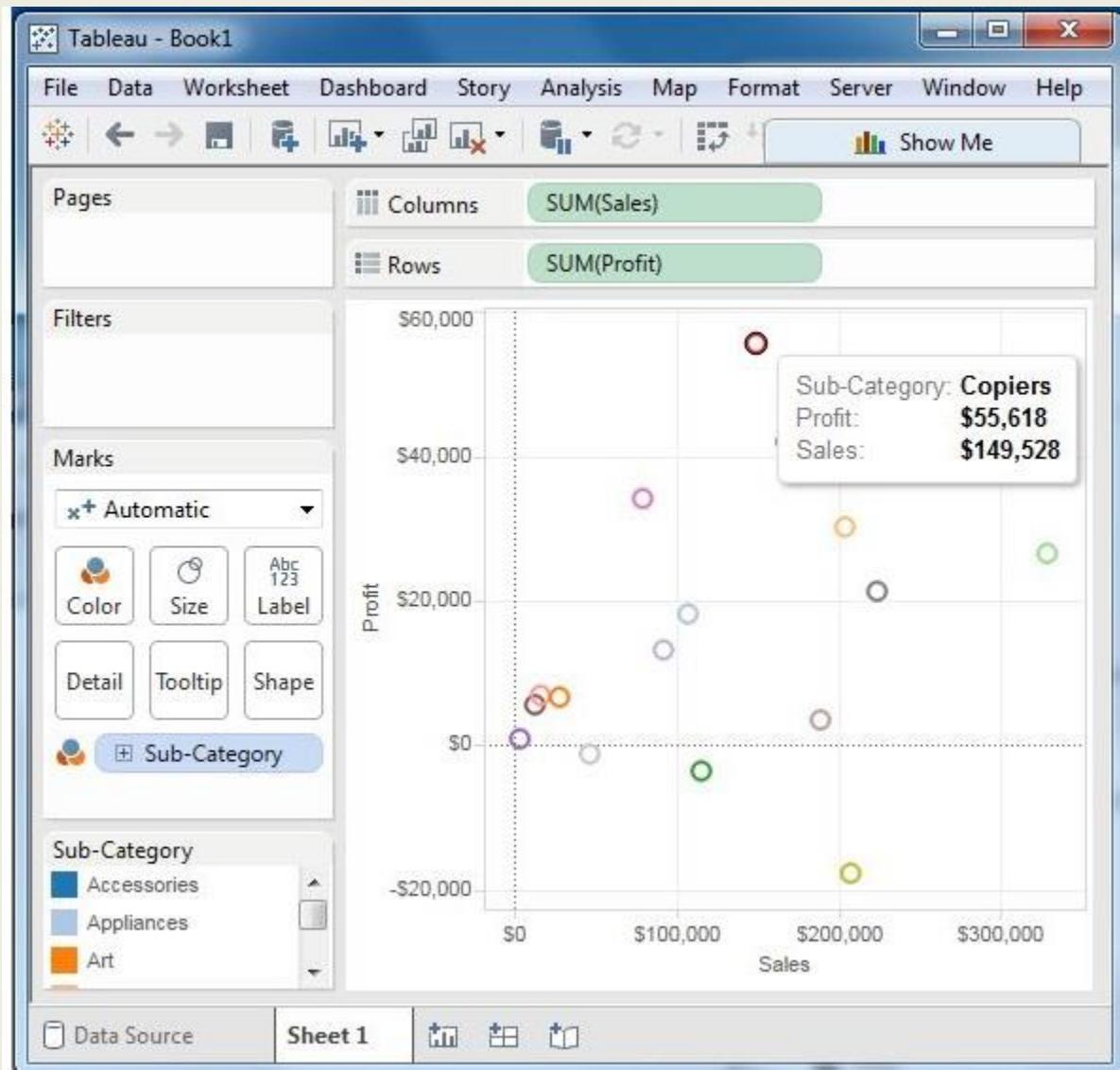
Using the Sample-superstore, let's aim to find the variation of sales and profit figures as the two axes of the Cartesian plane is distributed according to their Sub-Category. To achieve this objective, following are the steps.

**Step 1** – Drag and drop the measure Sales to the Columns shelf.

**Step 2** – Drag and drop the measure Profit to the Rows shelf.

**Step 3** – Pull the dimension Sub-Category to the labels Shelf under Marks.

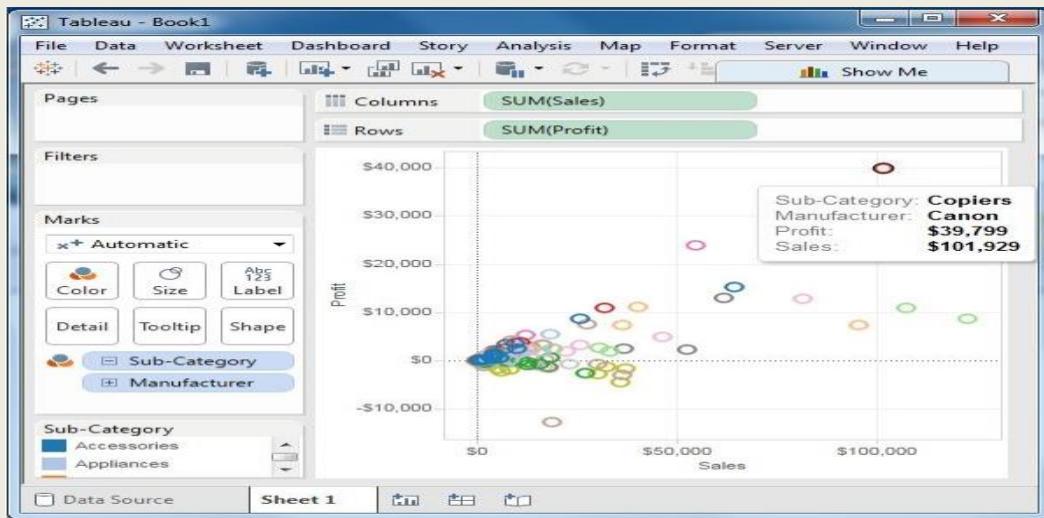
The following chart appears which shows how profit and sales is distributed across the Sub-Category of products.



**Scatter Plot - Color Encoded**

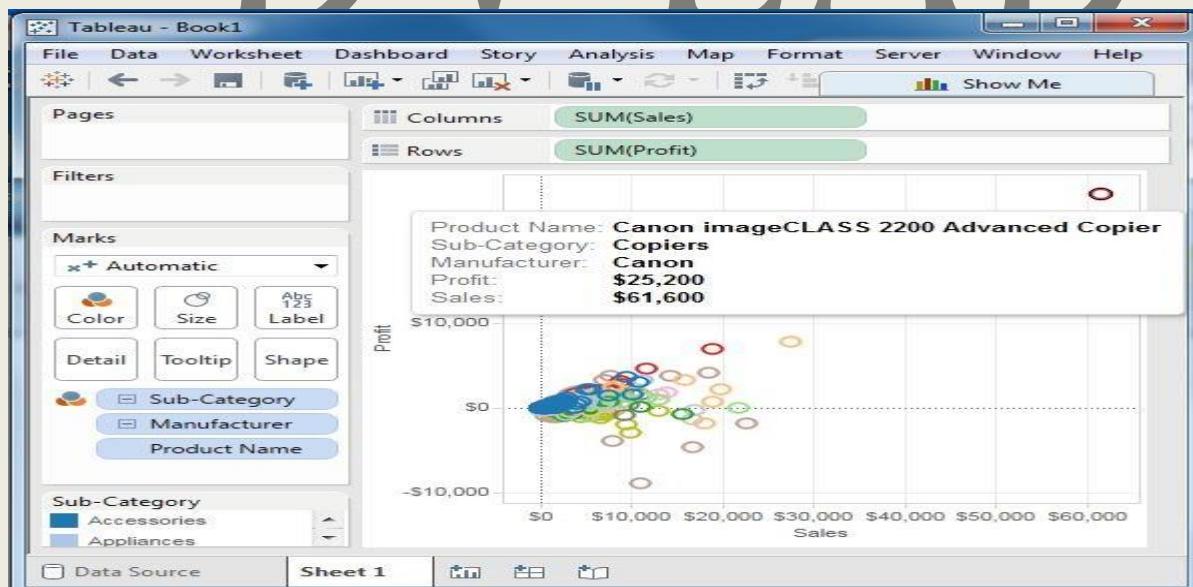


You can get the values color encoded by dragging the dimension Sub-Category to the color Shelf under the Marks card. This chart shows the scatter points with different color for each point.



## Drill-Down Scatter Plot

The same scatter plot can show different values when you choose a dimension with hierarchy. In the following example, we expand the Sub-Category field to show the scatter plot values for the Manufacturers.





Bubble charts display data as a cluster of circles. Each of the values in the dimension field represents a circle whereas the values of measure represent the size of those circles. As the values are not going to be presented in any row or column, you can drag the required fields to different shelves under the marks card.

### Simple Bubble Chart

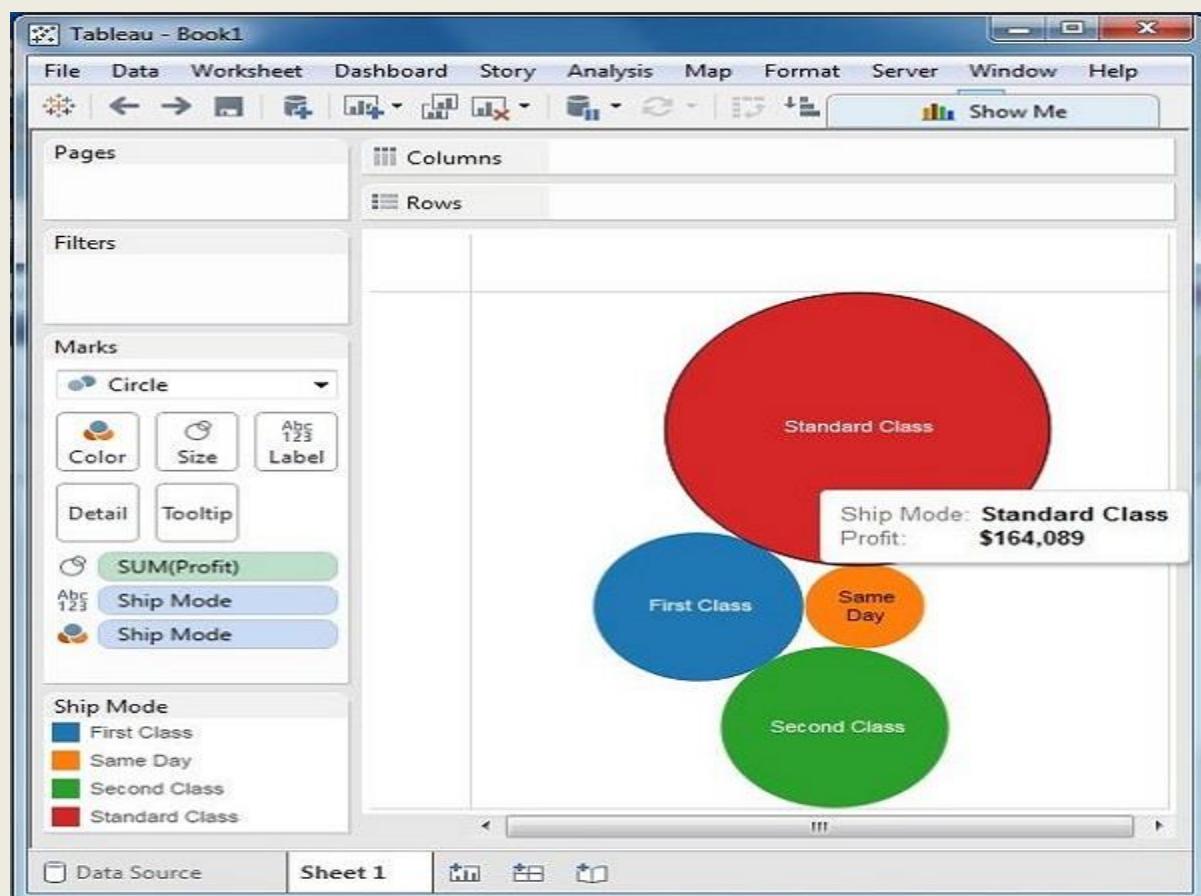
Using the Sample-superstore, let's plan to find the size of profits for different ship mode. To achieve this objective, following are the steps.

**Step 1** – Drag and drop the measure profit into the Size shelf under Marks card.

**Step 2** – Drag and drop the dimension ship mode into the Labels shelf under Marks card.

**Step 3** – Pull the dimension ship mode to the Colors shelf under Marks card.

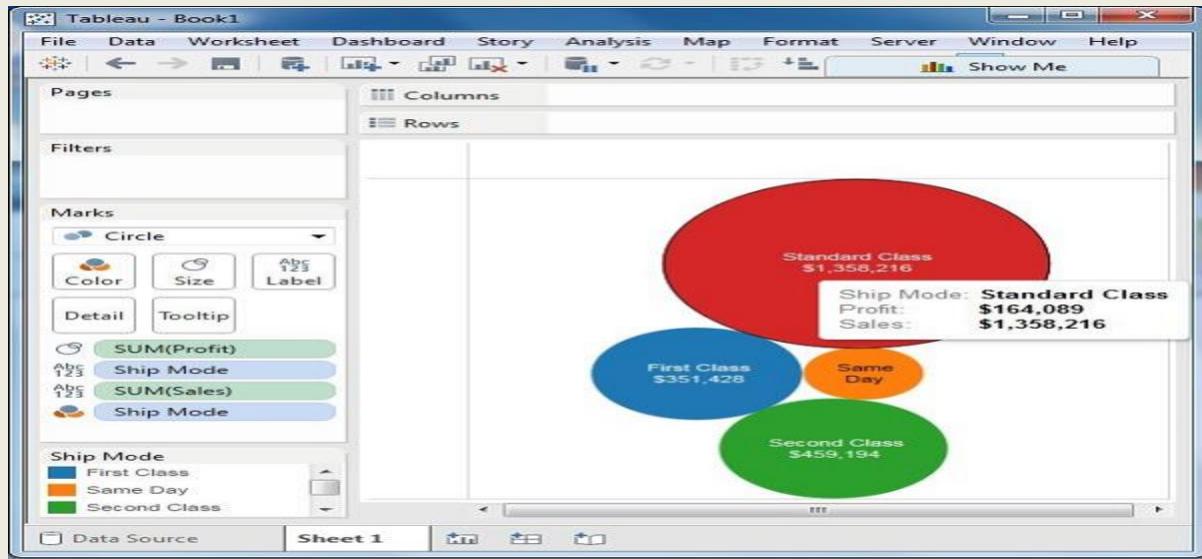
The following chart appears.





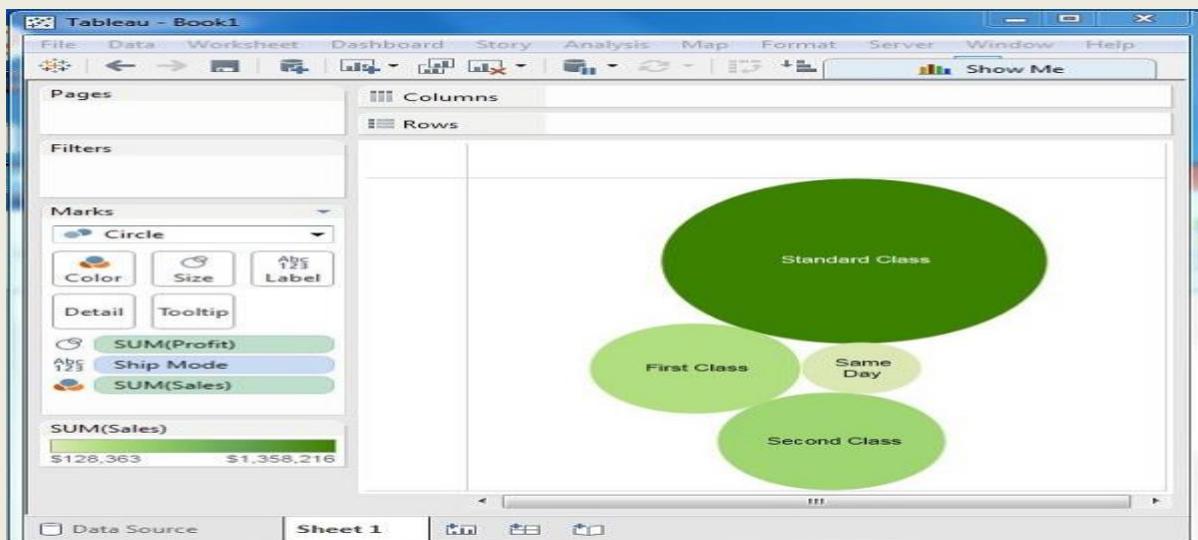
## Bubble Chart with Measure Values

You can also show the values of the measure field which decides the size of the circles. To do this, drag the sales measure into the Labels shelf. The following chart appears.



## Bubble Chart with Measure Colors

Instead of coloring each circle with a different color, you can use a single color with different shades. For this, drag the measure sales into the color shelf. The higher values represent darker shades while the smaller values represent lighter shades.





A bullet chart is a variation of Bar chart. In this chart, we compare the value of one measure with another measure in the context of finding the variation in the first measure within a range of variations in the second measure. It is like two bars drawn upon one another to indicate their individual values at the same position in the graph. It can be thought of as combining two graphs as one to view a comparative result easily.

### Creating Bullet Graph

Using the Sample-superstore, plan to find the size of profits for the respective sales figures in each Sub-Category. To achieve this objective, following are the steps.

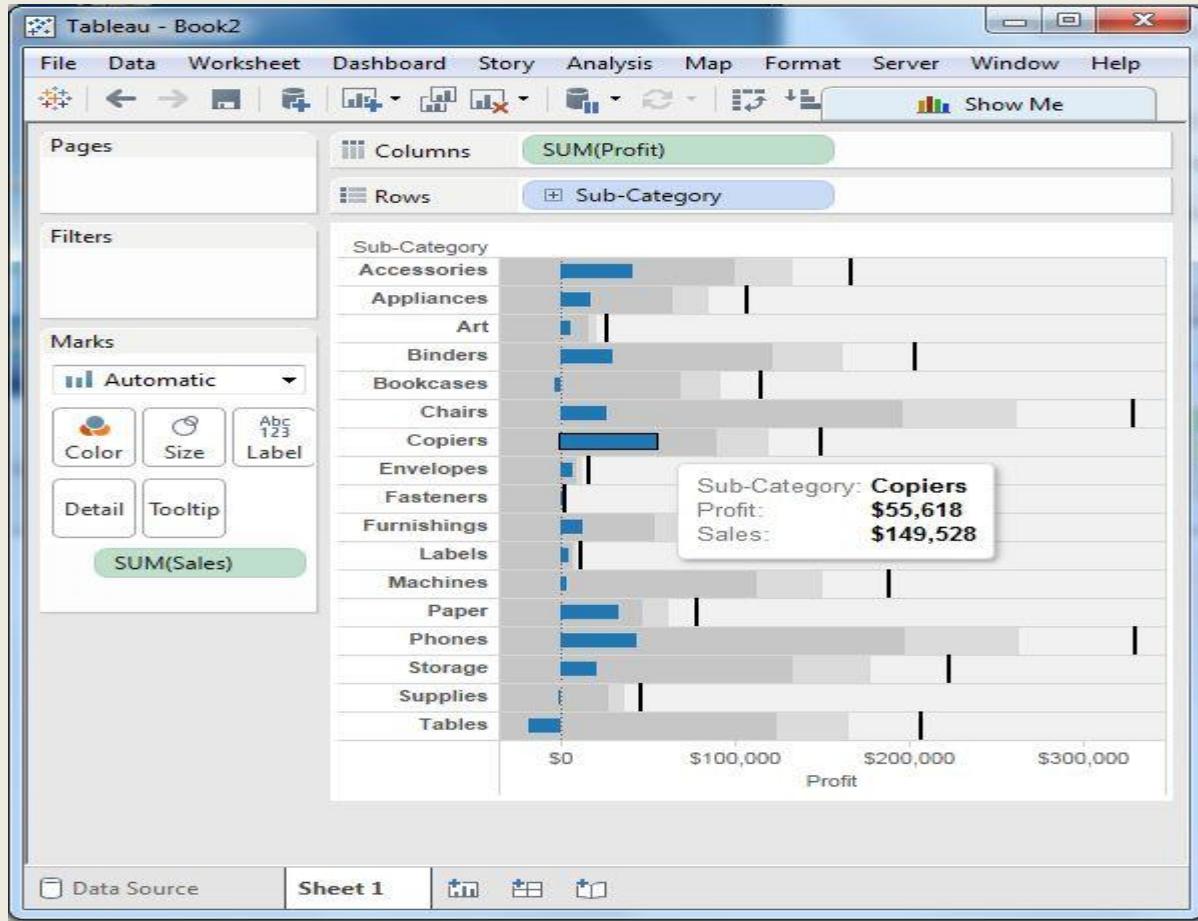
**Step 1** – Drag and drop the dimension Sub-Category from the data pane into the column shelf.

**Step 2** – Drag and drop the measures Profit and Sales to the Rows shelf.

The following chart appears which shows the two measures as two separate categories of bar charts, each representing the values for sub-categories.



**Step 3** – Drag the sales measure to the Marks card. Using Show Me, choose the bullet graph option. The following chart shows the bullet graph.



The box plots are also known as a box-and-whisker plots. They show the distribution of values along an axis. Boxes indicate the middle 50 percent of the data which is, the middle two quartiles of the data's distribution. The remaining 50 percent of data on both sides is represented by lines also called whiskers, to display all points within 1.5 times the interquartile range, which is all points within 1.5 times the width of the adjoining box, or all points at the maximum extent of the data.

The Box Plots take one or more measures with zero or more dimensions.

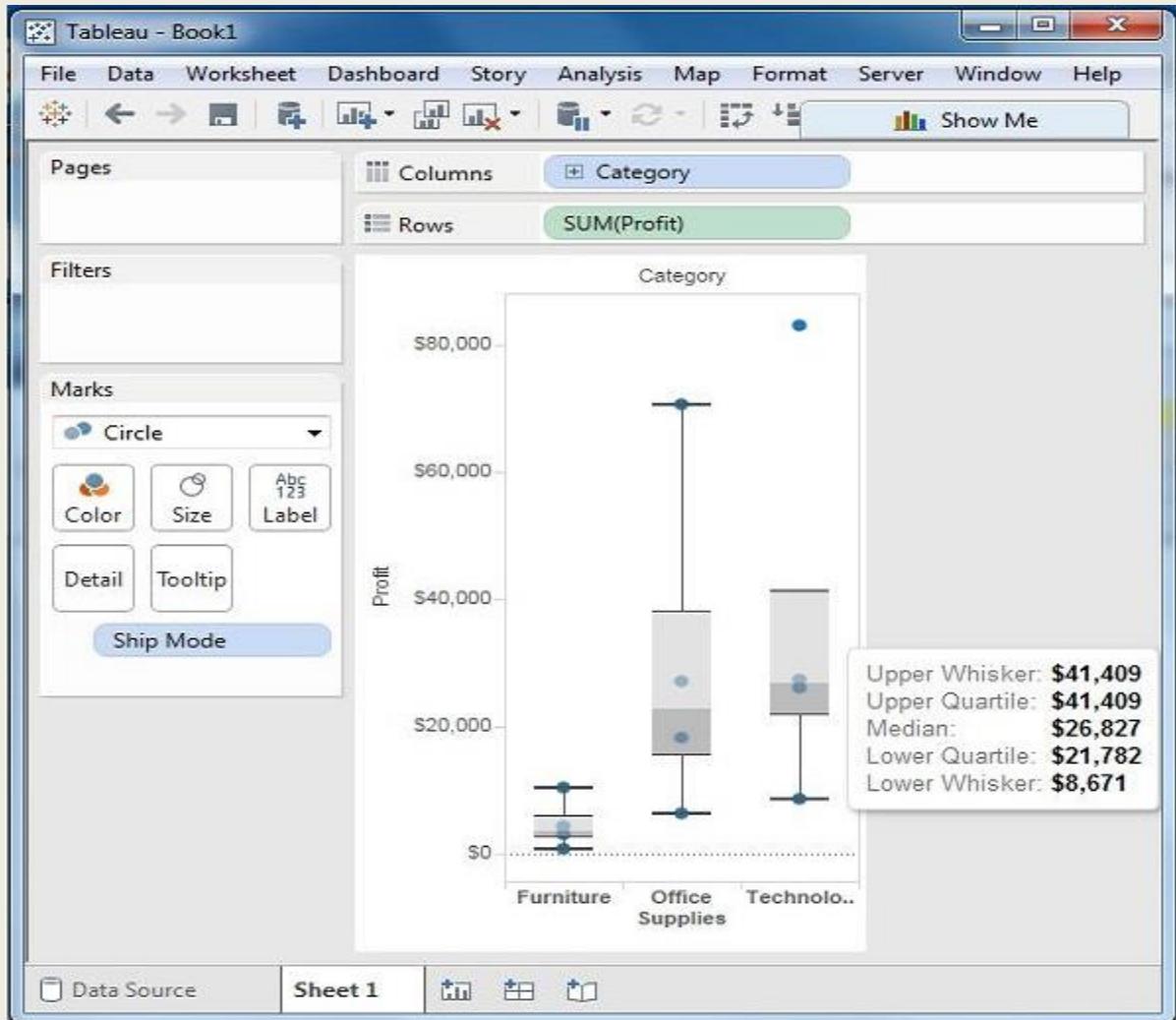
### Creating a Box Plot

Using the Sample-superstore, plan to find the size of profits for the respective category for each Ship mode values. To achieve this objective, following are the steps.

**Step 1** – Drag and drop the dimension category to the Columns shelf and profit to the Rows shelf. Also drag the dimension Ship mode to the right of Category in Columns shelf.



**Step 2** – Choose Box-and-Whisker plot from Show Me. The following chart appears which shows the box plots. Here, Tableau automatically reassigns the ship mode to the Marks card.



The tree map displays data in nested rectangles. The dimensions define the structure of the tree map and measures define the size or color of the individual rectangle. The rectangles are easy to visualize as both the size and shade of the color of the rectangle reflect the value of the measure.

A Tree Map is created using one or more dimension with one or two measures.

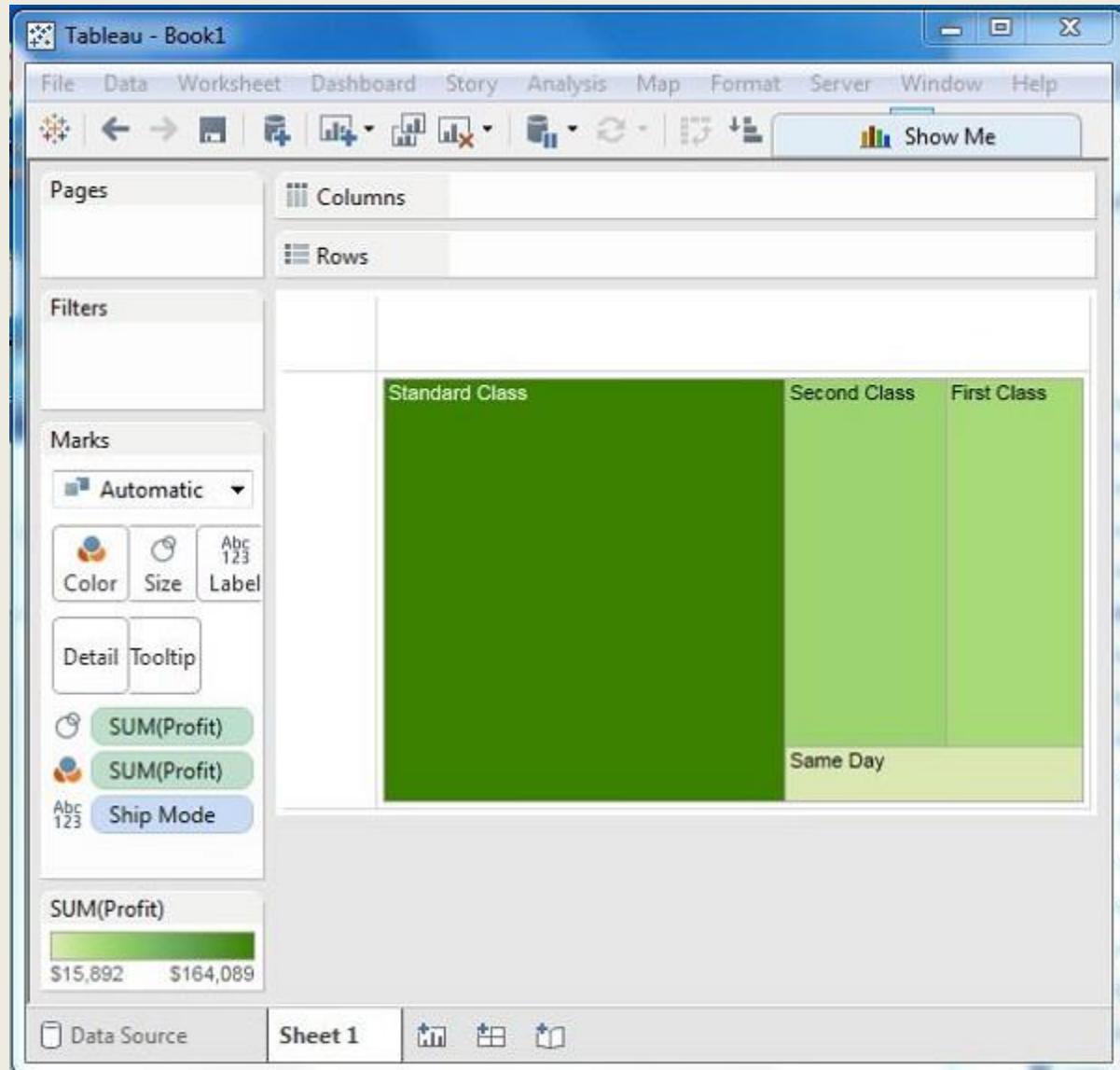
### **Creating a Tree Map**

Using the Sample-superstore, plan to find the size of profits for each Ship mode values. To achieve this objective, following are the steps.

**Step 1** – Drag and drop the measure profit two times to the Marks Card. Once to the Size shelf and again to the Color shelf.



**Step 2** – Drag and drop the dimension ship mode to the Label shelf. Choose the chart type Tree Map from Show Me. The following chart appears.



### Tree Map with Two Dimensions

You can add the dimension Region to the above Tree map chart. Drag and drop it twice. Once to the Color shelf and again to the Label shelf. The chart that appears will show four outer boxes for four regions and then the boxes for ship modes nested inside them. All the different regions will now have different colors.

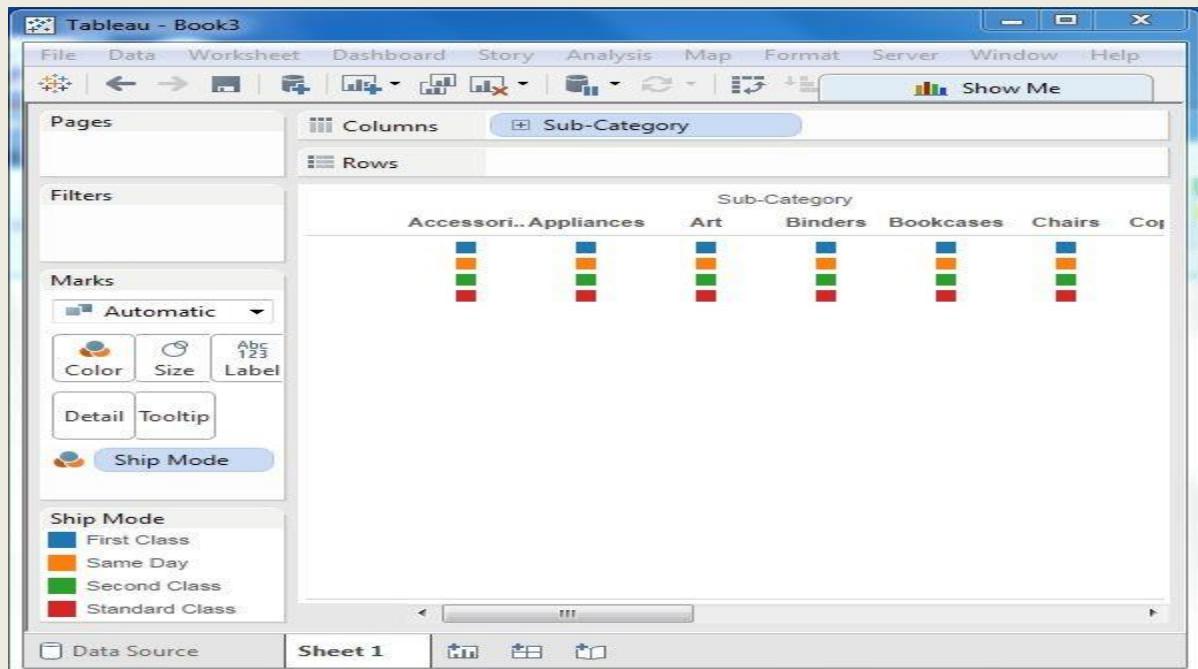


A Bump Chart is used to compare two dimensions against each other using one of the Measure value. They are very useful for exploring the changes in Rank of a value over a time dimension or place dimension or some other dimension relevant to the analysis. The Bump Chart takes two dimensions with zero or more measures.

### Creating a Bump Chart

Using the Sample-superstore, plan to find the variation of ship mode of products with the variation of the Sub-Category. To achieve this objective, following are the steps.

**Step 1** – Drag and drop the dimension Sub-Category to the Columns shelf. Also drag the dimension Ship mode to the Color shelf under Marks card. Leave the chart type to Automatic. The following chart appears.



**Step 2** – Next, create a calculated field called Rank. Go to Analysis → Create Calculated Field. Use Rank as the field name and write the expression index () in the calculation area. It is an inbuilt function that creates an index for the current row in the partition. Click OK and the new field will be visible in the measures section. Right-click on the field Rank and convert it to discrete.

**Step 3** – Drag Rank to the Rows shelf. The following chart appears which shows the dimension Sub-Category with each ship mode arranged in an increasing order of their Rank value.



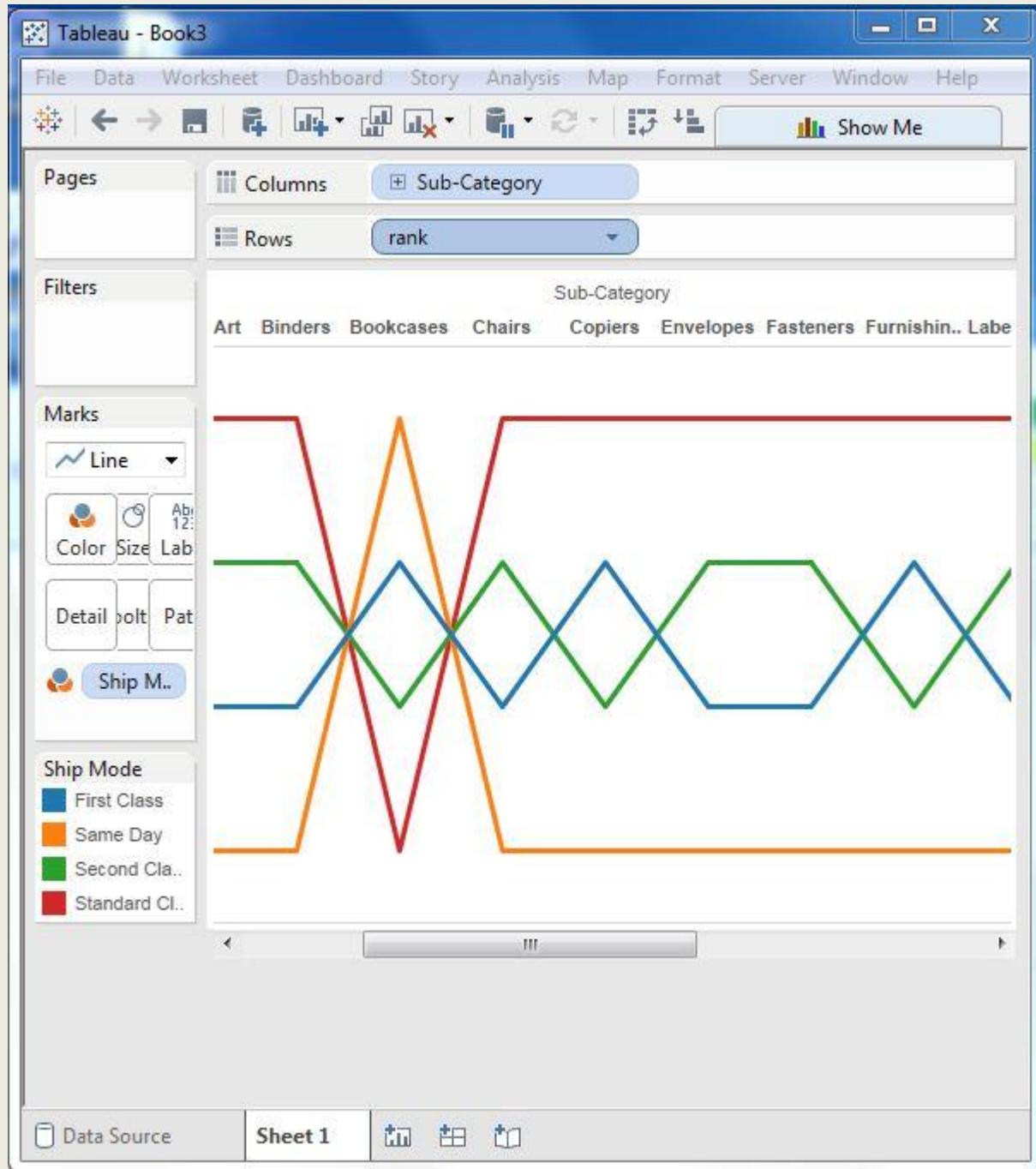
The screenshot shows the Tableau interface with a dashboard titled "Book3". The left pane displays the data source "Sample - Superstore" with dimensions for Ship Date, Ship Mode, Location (Country, State, City, Postal Code), and Product (Category, Sub-Category, Manufacturer, Product Name). Measures include Profit Ratio, Quantity, rank, Sales, and sets for Top Customers by Profit. Parameters define Profit Bin Size and Top Customers. The right pane shows a table with columns "rank", "Sub-Category", "Accessori..Appliances", and "Art". The "rank" column has values 1 through 9. The "Sub-Category" column lists "Accessori..Appliances", "Art", "Binders", "Bookcases", and "Chairs". The "Accessori..Appliances" row is highlighted with a blue background. The "Ship Mode" mark is selected in the Marks panel.

**Step 4 –** Apply some more calculation to the rank field using the measure Profit. Right click on Rank and choose Edit Table calculation. Choose the sorting by the field profit using partition by Sub-Category and addressed by ship mode. The following screenshot shows the calculations applied.

The screenshot shows the Tableau interface with the "Table Calculation [rank]" dialog box open. The "Calculation Definition" section shows "Compute using: Advanced..." and "At the level: Sub-Category". The "Advanced" section contains "Partitioning: Sub-Category" and "Addressing: Ship Mode". Under "Sort", the "Field:" option is selected with "Profit" and "Sum" as the sort order. The "Ascending" radio button is selected. The "OK" and "Cancel" buttons are at the bottom right of the dialog.



On completion of the above steps, you will get the bump chart as shown in the following screenshot. It shows the variation of profit for each ship mode across various subcategories.



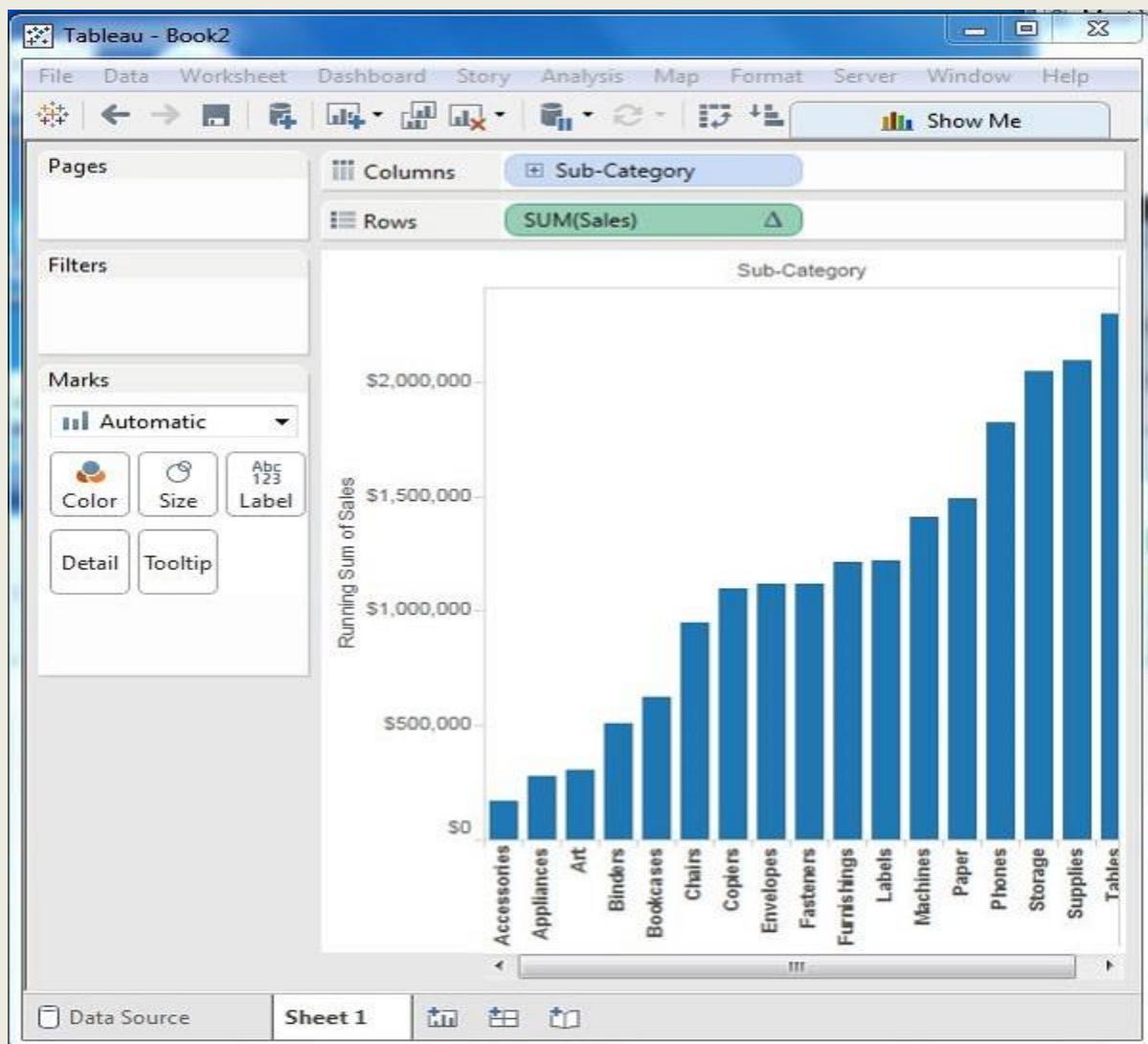
Waterfall charts effectively display the cumulative effect of sequential positive and negative values. It shows where a value starts, ends and how it gets there incrementally. So, we are able to see both the size of changes and difference in values between consecutive data points. Tableau needs one Dimension and one Measure to create a Waterfall chart.



## Creating a Waterfall Chart

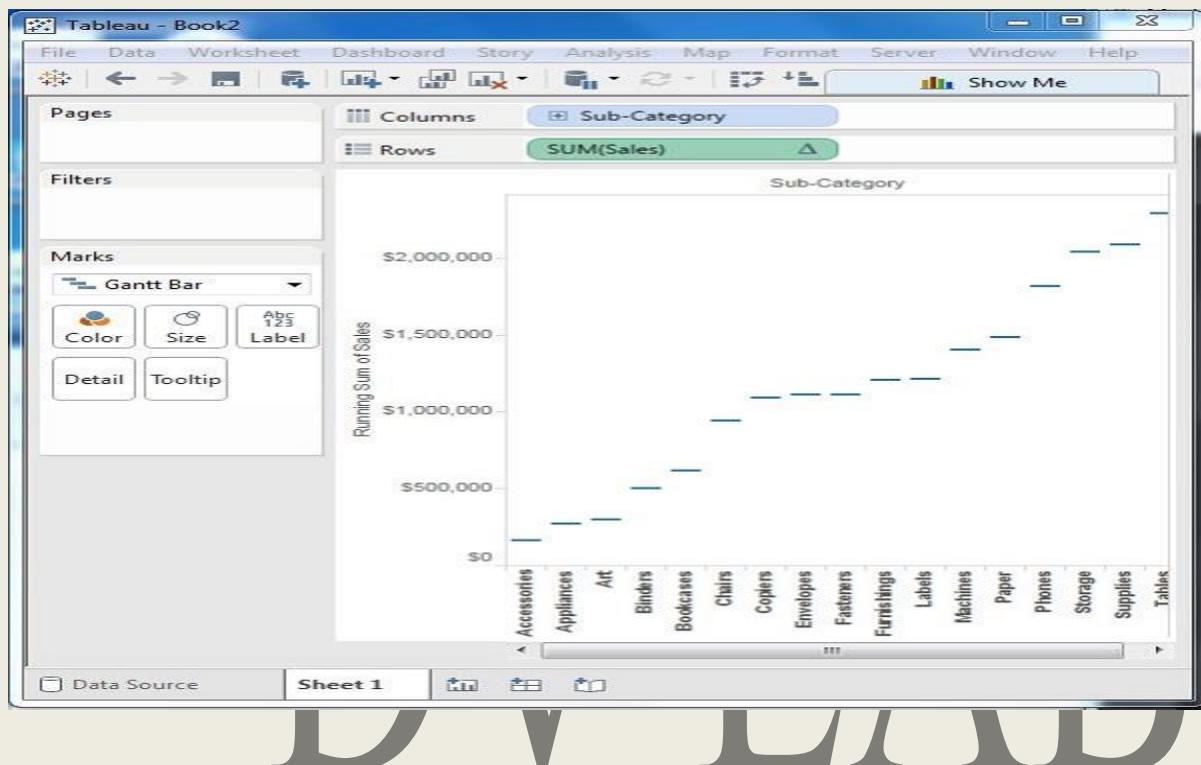
Using the Sample-superstore, plan to find the variation of Sales for each Sub-Category of Products. To achieve this objective, following are the steps.

**Step 1** – Drag the Dimension Sub-Category to the Columns shelf and the Measure Sales to the Rows shelf. Sort the data in an ascending order of sales value. For this, use the sort option appearing in the middle of the vertical axis when you hover the mouse over it. The following chart appears on completing this step.

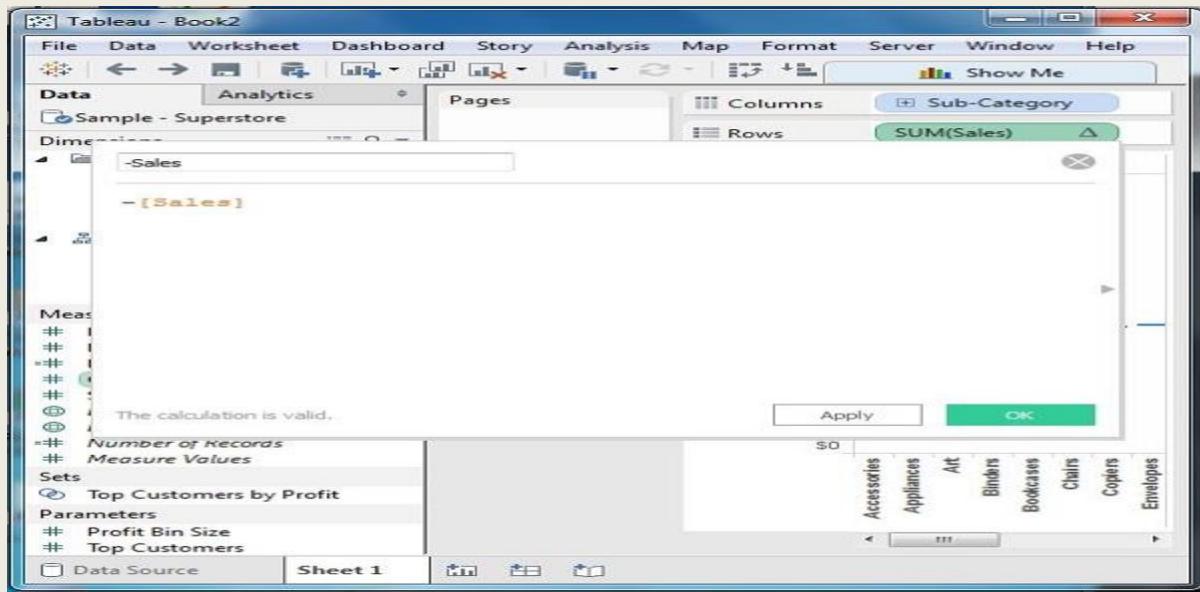




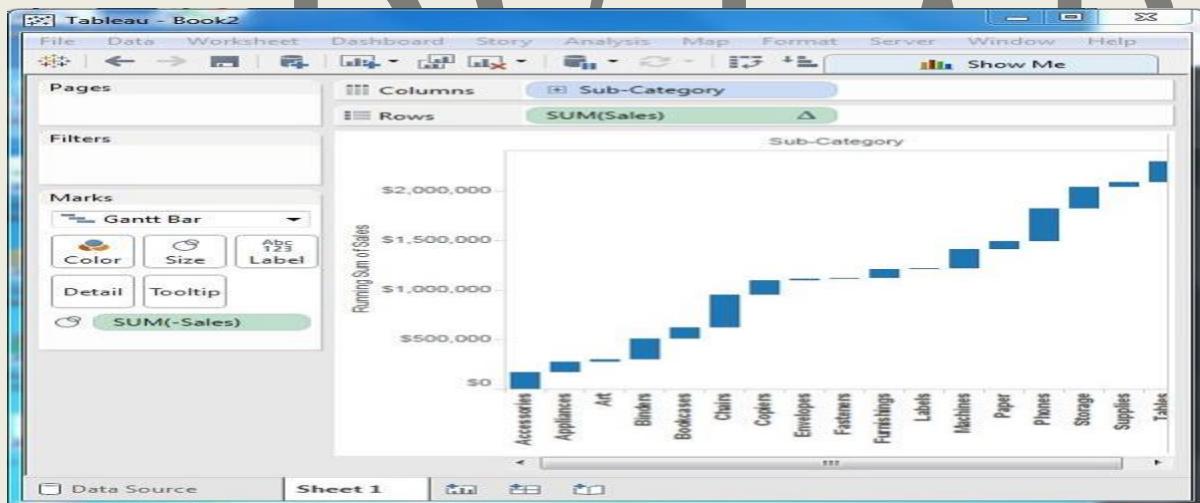
**Step 2** – Next, right-click on the SUM (Sales) value and select the running total from the table calculation option. Change the chart type to Gantt Bar. The following chart appears.



**Step 3** – Create a calculated field named **-sales** and mention the following formula for its value.

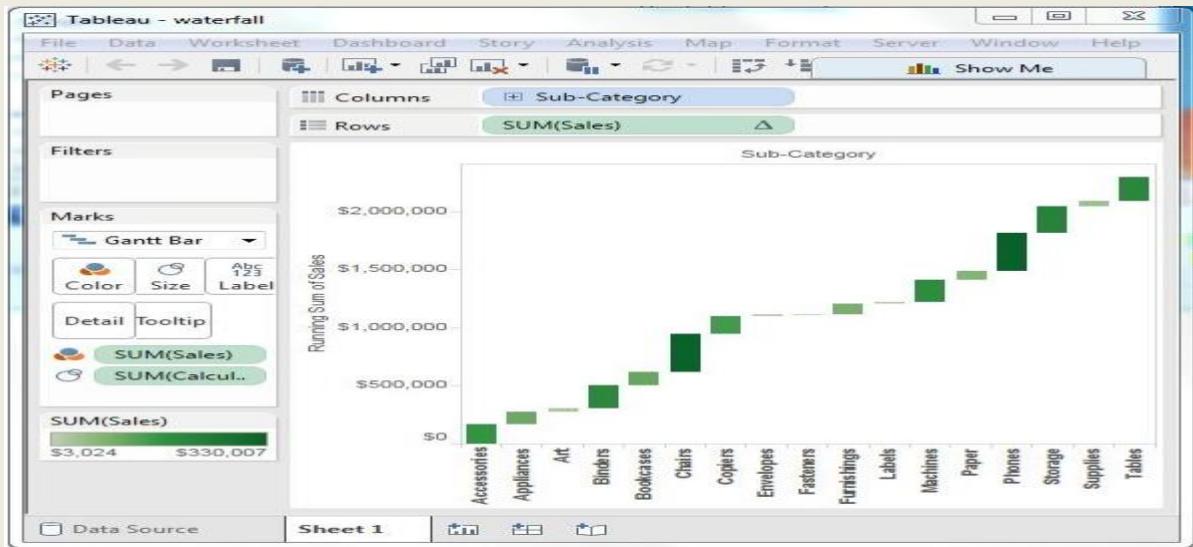


**Step 4** – Drag the newly created calculated field (**-sales**) to the size shelf under Marks Card. The chart above now changes to produce the following chart which is a Waterfall chart.



### Waterfall Chart with Color

Next, give different color shades to the bars in the chart by dragging the Sales measure to the Color shelf under the Marks Card. You get the following waterfall chart with color.



### **PROGRAM 8:**

**AIM: Creation of Dashboard (Optional).**

# DV LAB

**Explanation:** A dashboard is a consolidated display of many worksheets and related information in a single place. It is used to compare and monitor a variety of data simultaneously. The different data views are displayed all at once. Dashboards are shown as tabs at the bottom of the workbook and they usually get updated with the most recent data from the data source. While creating a dashboard, you can add views from any worksheet in the workbook along with many supporting objects such as text areas, web pages, and images.

Each view you add to the dashboard is connected to its corresponding worksheet. So when you modify the worksheet, the dashboard is updated and when you modify the view in the dashboard, the worksheet is updated.

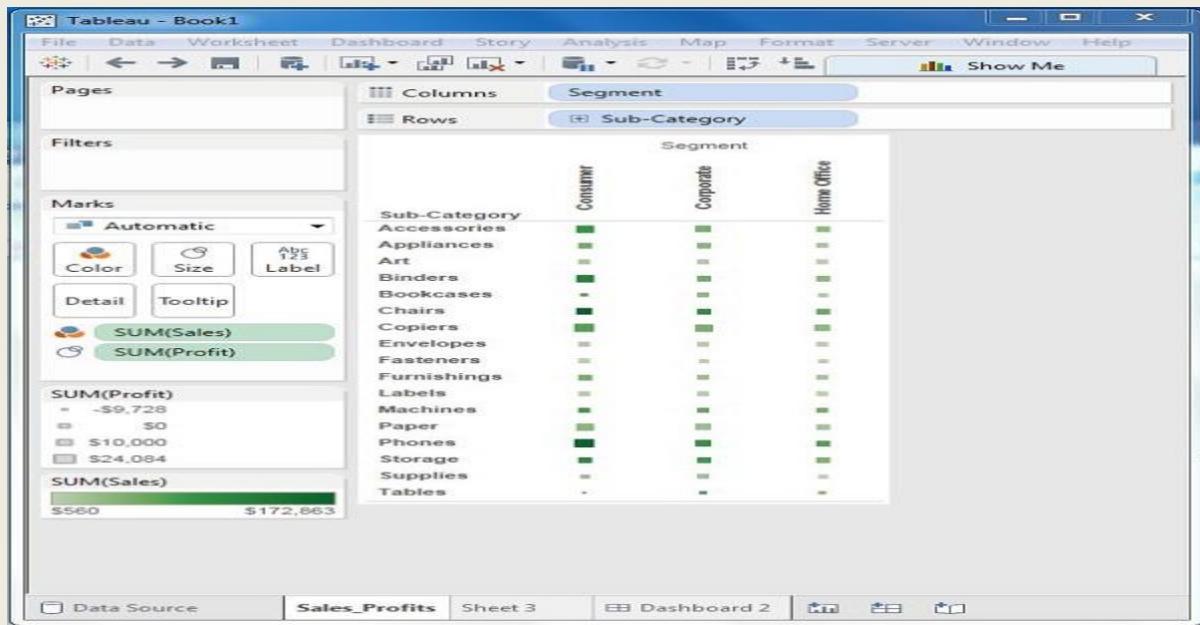
### **Creating a Dashboard**

Using the Sample-superstore, plan to create a dashboard showing the sales and profits for different segments and Sub-Category of products across all the states. To achieve this objective, following are the steps.

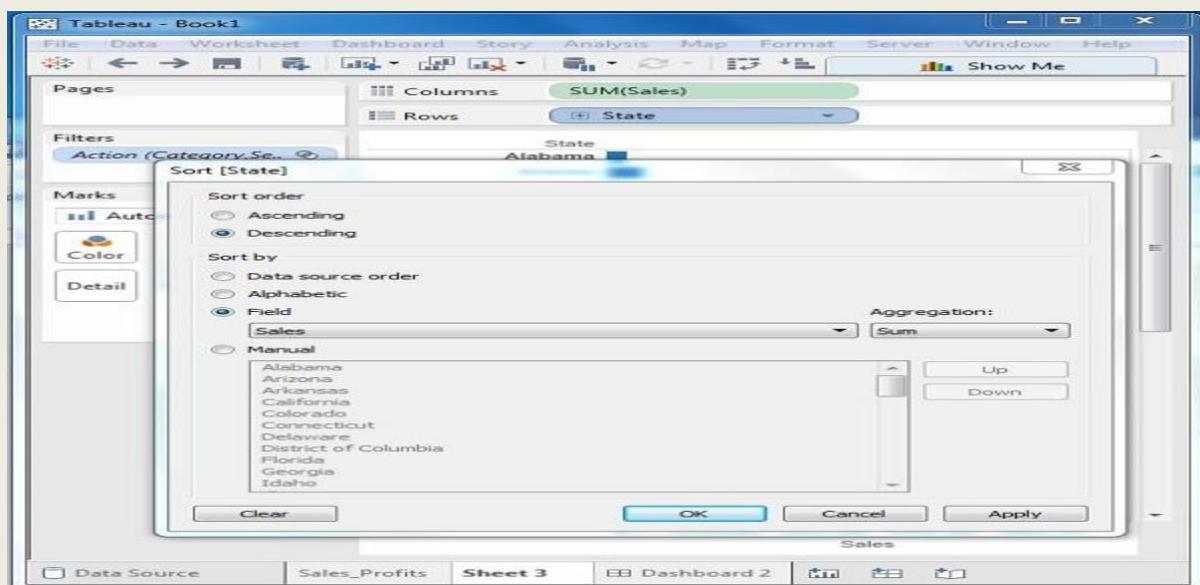
**Step 1 –** Create a blank worksheet by using the add worksheet icon located at the bottom of the workbook. Drag the dimension Segment to the columns shelf and the dimension Sub-Category



to the Rows Shelf. Drag and drop the measure Sales to the Color shelf and the measure Profit to the Size shelf. This worksheet is referred as the Master worksheet. Right-click and rename this worksheet as **Sales\_Profits**. The following chart appears.



**Step 2** – Create another sheet to hold the details of the Sales across the States. For this, drag the dimension State to the Rows shelf and the measure Sales to the Columns shelf as shown in the following screenshot. Next, apply a filter to the State field to arrange the Sales in a descending order. Right-click and rename this worksheet as **Sales\_state**.





**Step 3** – Next, create a blank dashboard by clicking the Create New Dashboard link at the bottom of the workbook. Right-click and rename the dashboard as Profit\_Dashboard.

The screenshot shows the Tableau software interface with a new dashboard named "Profit\_Dashboard". The dashboard area is currently empty, with a placeholder text "Drop sheets here". On the left, there's a sidebar with various objects like Horizontal, Vertical, Text, and Images, and layout options for Tiled or Floating. At the bottom, the dashboard properties show a size of 1000x800 pixels. The bottom navigation bar includes tabs for Data Source, Sales\_Profits, Sales\_state, and Profit\_Dashboard.

**Step 4** – Drag the two worksheets to the dashboard. Near the top border line of Sales Profit worksheet, you can see three small icons. Click the middle one, which shows the prompt Use as Filter on hovering the mouse over it.

The screenshot shows the Tableau software interface with two worksheets open: "Sales\_Profits" and "Sales\_state". The "Sales\_Profits" worksheet contains a list of products under "Sub-Category" and their corresponding "Segment" (Consumer, Corporate, Home Office). The "Sales\_state" worksheet is a bar chart showing sales by state. A tooltip "Use as filter" appears over the top border of the "Sales\_Profits" worksheet, indicating that the data in this sheet can be used as a filter for the other sheet. The bottom navigation bar includes tabs for Data Source, Sales\_Profits, Sales\_state, and Profit\_Dashboard.



**Step 5** – Now in the dashboard, click the box representing Sub-Category named Machines and segment named Consumer.

You can notice that only the states where the sales happened for this amount of profit are filtered out in the right pane named **Sales\_state**. This illustrates how the sheets are linked in a dashboard.

