

An introduction to time series

TIME SERIES ANALYSIS IN TABLEAU



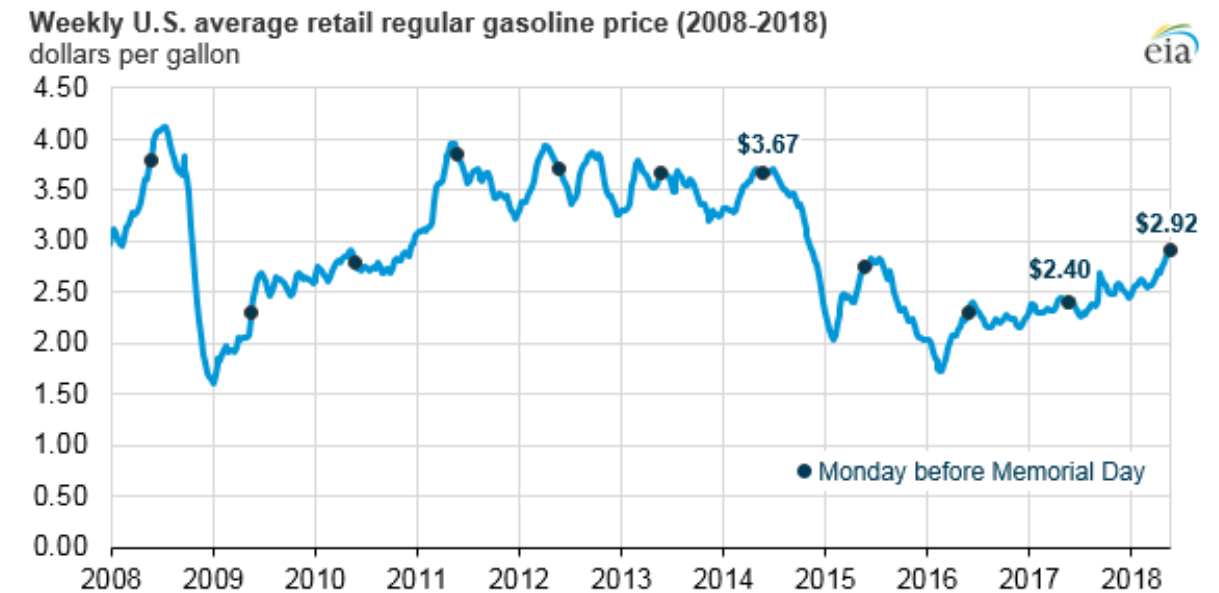
Christopher Hui
VP of Product, Tracked

What's time series data?

- A sequence of observations taken at regular or irregular intervals over time
- Granularity references the time period over which the data is collected (e.g. daily, weekly, monthly etc.)

Typical time series data might include:

- Daily fuel prices
- LinkedIn posting time
- Ridership patterns for e-Bikes



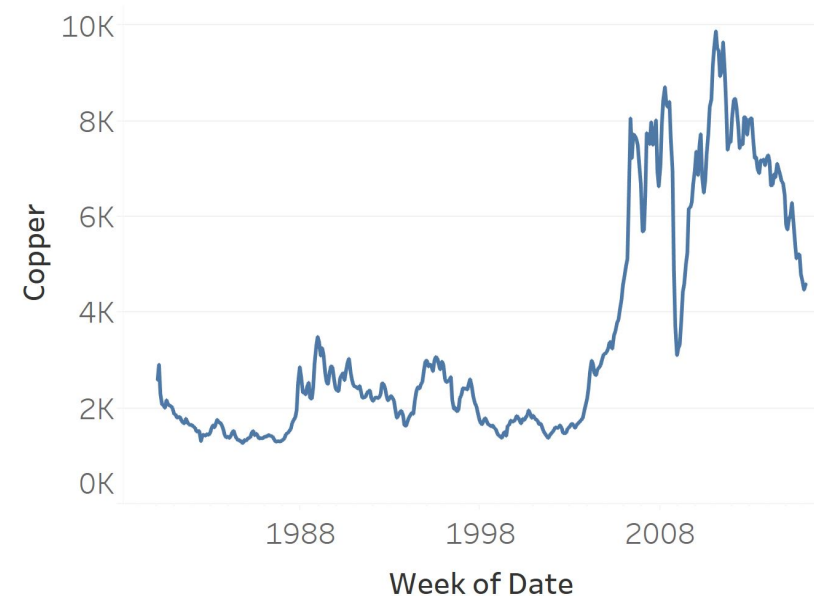
¹ <https://www.eia.gov/todayinenergy/detail.php?id=33562>

Univariate or multivariate?

Univariate

- Univariate time series analysis refers to the analysis of a **single** variable over time (e.g. Sales of a product over the past few years)

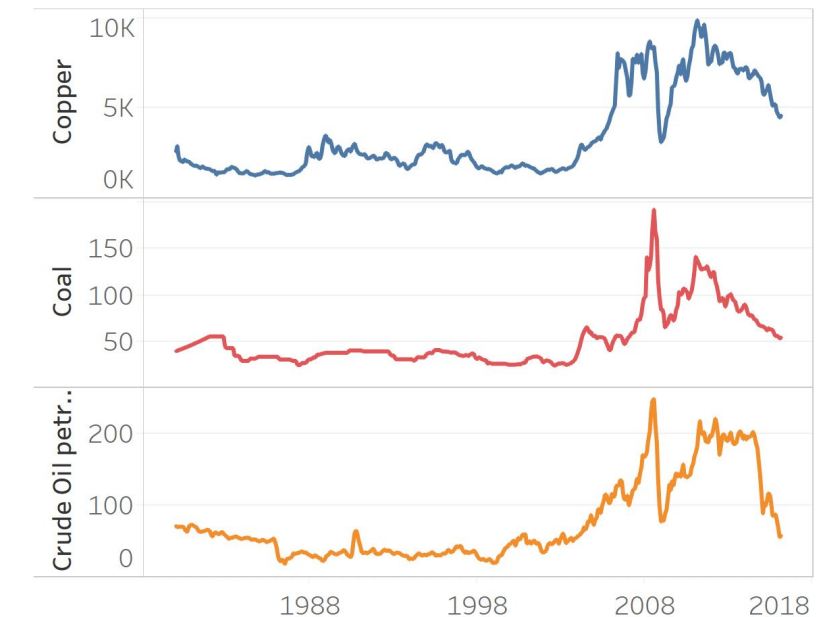
Univariate timeseries



Multivariate

- Multivariate time series analysis is the analysis of **multiple variables** that are measured over time

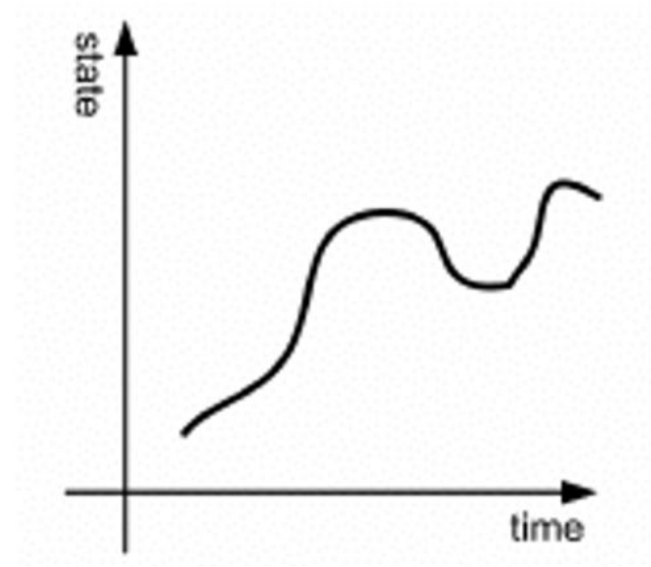
Multivariate timeseries



Continuous or discrete?

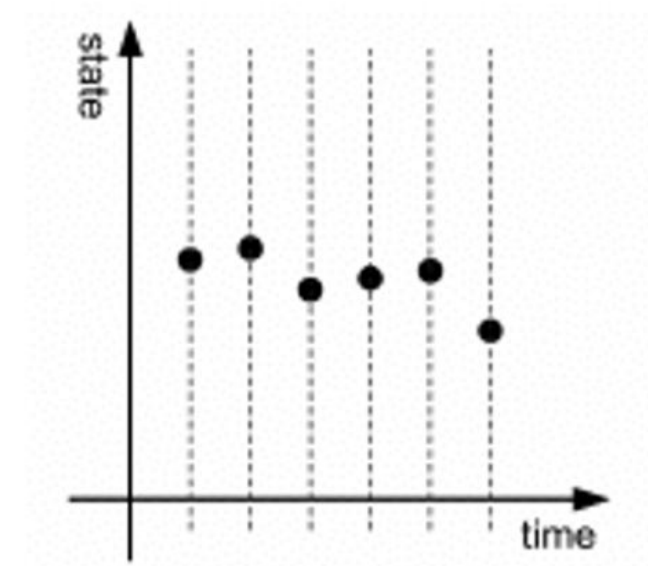
Continuous time model

- Used when data is measured continuously and not at fixed intervals (e.g. stock prices)
- These models take into account the exact time interval between measurements



Discrete time model

- Used when data is measured and recorded at specific intervals (e.g. daily rainfall)
- Does not take into account the time intervals between measurements



Formatting date time

- Common **date time formatting** functions include:
- Formatting functions are focused on manipulating the datetime string to suit the granularity of interest. (e.g. year to quarter)

- DATENAME()
- DATEPART()
- DATETRUNC()

Exploring date time

- Common **date time exploration** functions include:
 - DATEDIFF()
 - DATEADD()
- Exploration functions are focused on calculations using the time series data explicitly (i.e. days between customer purchases)

The dataset - Citibike data



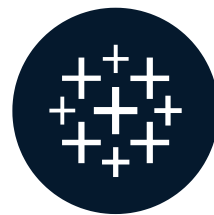
ride_id	started_at	ended_at	customer_typing	rideable_type
3BF46E8C8FB64...	4/11/2021 4:17:...	4/11/2021 4:21:...	member	classic_bike
612E2B40F80C1...	4/11/2021 3:15:...	4/11/2021 3:21:...	member	classic_bike
A44D96DB93835...	4/11/2021 9:25:...	4/11/2021 9:40:...	member	classic_bike
14E52E500DB01...	2/11/2021 6:36:...	2/11/2021 6:51:...	member	classic_bike
045E60BE6E28F...	6/11/2021 5:19:...	6/11/2021 5:30:...	member	classic_bike
D1620B9E84F5E...	2/11/2021 8:14:...	2/11/2021 8:39:...	member	classic_bike
D28C5F358FDDC...	5/11/2021 10:4...	5/11/2021 10:47...	casual	electric_bike
CB33C45691D56...	3/11/2021 1:50:...	3/11/2021 2:08:...	member	classic_bike
21FA707A9ED36...	3/11/2021 5:15:...	3/11/2021 5:21:...	member	classic_bike

Let's practice!

TIME SERIES ANALYSIS IN TABLEAU

Date time formatting in Tableau

TIME SERIES ANALYSIS IN TABLEAU



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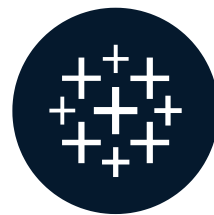
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TIME SERIES ANALYSIS IN TABLEAU

Date transformations and visualizations

TIME SERIES ANALYSIS IN TABLEAU



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Date time specific data types



Tableau treats date time data in a unique way:

- Date data is returned as either a **date** or **date-time** format

Color based markers indicate data type:

- Blue icons indicate **discrete** data
- Green icons indicate **continuous** data

VISUAL CUE	DESCRIPTION
Abc =Abc	The field contains text values.
# =#	The field contains numeric values.
=#	The field is a calculation defined on the server.
☞ ☞	The field contains only date values.
☞	The field contains both date and time values.

Abc Bike!Share!Data!7D!Tableau!WA...	 Bike!Share!Data!7D!Tableau!WA...	 Calculation
Ride Id	Start Time Date Time	Start Time Date
117EFE10D81301C1	3/11/2021 3:05:19 pm	3/11/2021
80C8D7B8FEABFC9D	17/11/2021 6:38:58 pm	17/11/2021
469CFE3C3C875197	17/11/2021 12:57:05 pm	17/11/2021
4C90CE93FB3C29C6	18/11/2021 4:14:45 pm	18/11/2021
49C267F472857038	18/11/2021 1:26:39 pm	18/11/2021
098969D953F827AD	18/11/2021 12:12:58 pm	18/11/2021
911E219285E1DDE9	18/11/2021 1:48:40 am	18/11/2021

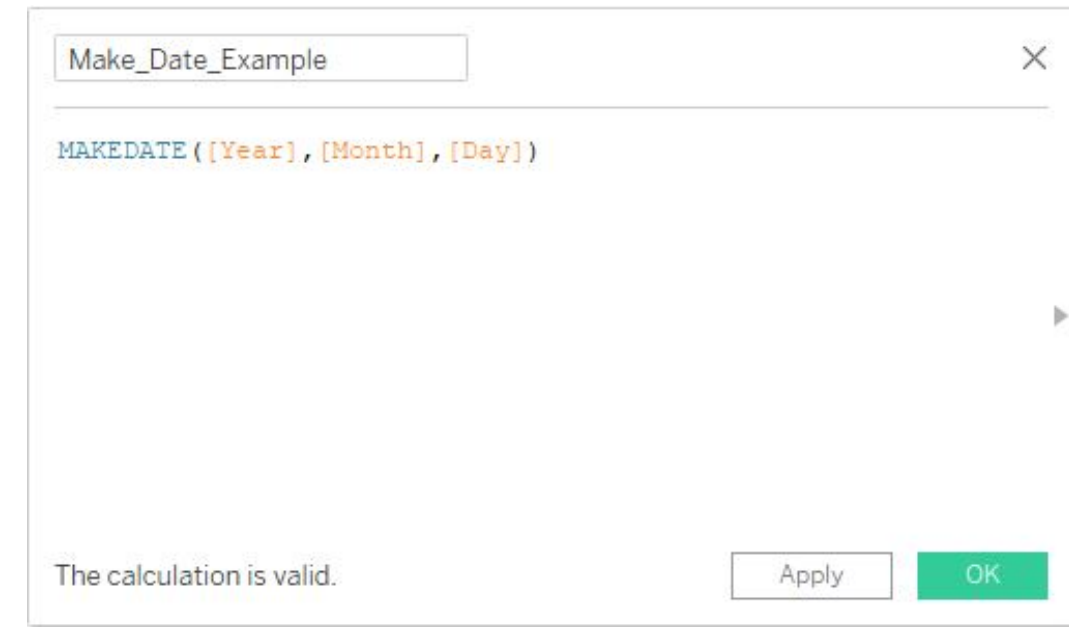
Date time data models

- Date time data can be provided in a date dimension format
- Each dimension of the date field is split into its smallest measure
- To deal with date data in this format, you can use the `MAKEDATE()` function to reconstruct a singular date field

Abc Bike!Share!Data!7D!Tableau!WADS Ride Id	# Bike!Share!Data!7D!Tableau!WADS Start Day	# Bike!Share!Data!7D!Tableau!WADS Start Month	# Bike!Share!Data!7D!Tableau!WADS Start Year	# Bike!Share!Data!7D!Tableau!WADS Start Hour
117EFE10D81301C1	3	11	2021	15
80C8D7B8FEABFC9D	3	11	2021	18
469CFE3C3C875197	3	11	2021	12
4C90CE93FB3C29C6	4	11	2021	16
49C267F472857038	4	11	2021	13
098969D953F827AD	4	11	2021	12
911E219285E1DDE9	4	11	2021	1

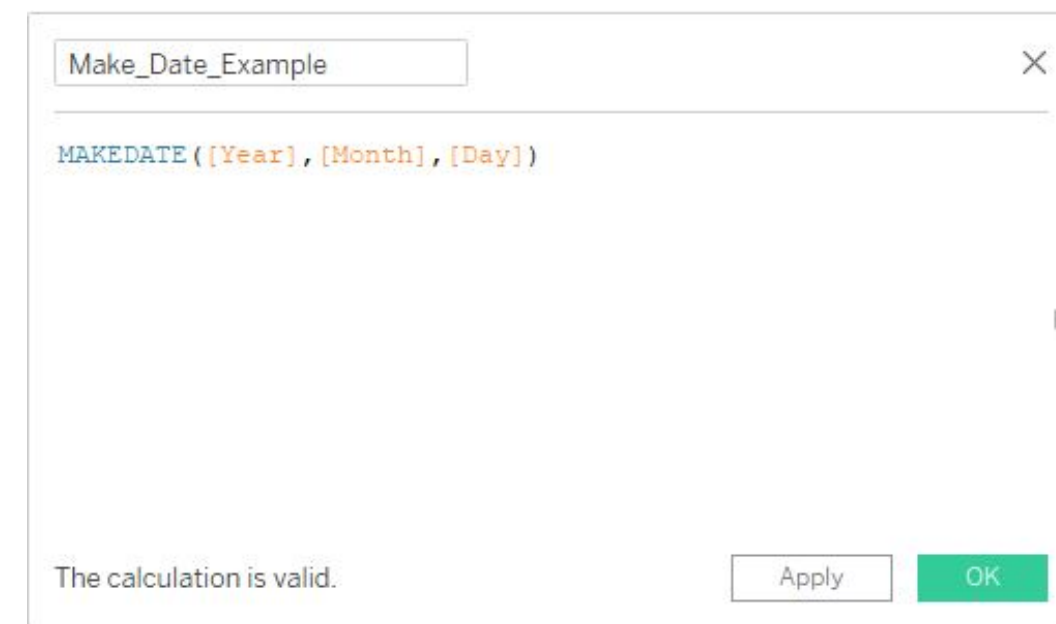
Making dates in Tableau

- `MAKEDATE()` is a date formatting function that enables reconstruction of date time objects from separate date time fields
- `MAKEDATE()` assumes the dates provided are valid and **does not have any inbuilt validation**



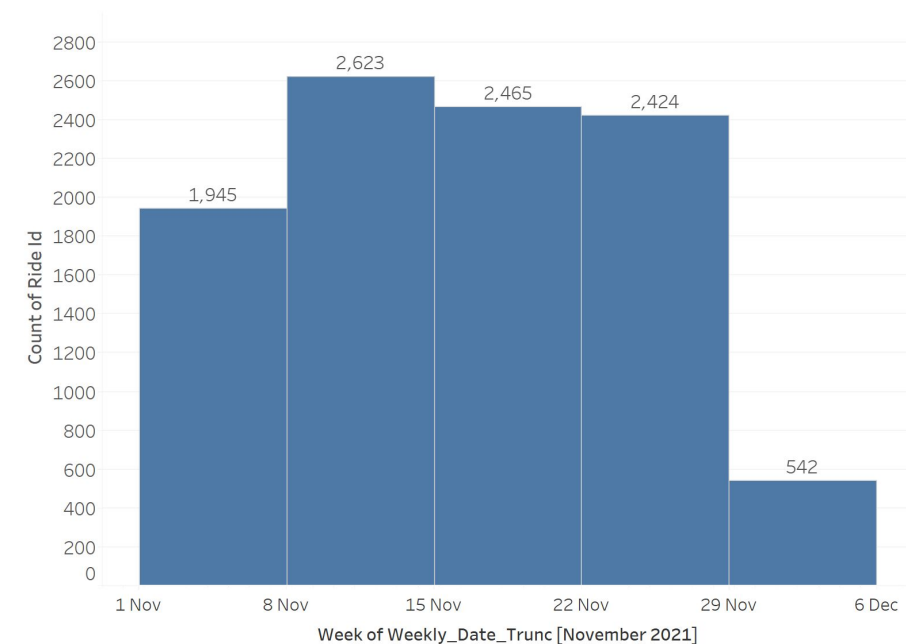
Making time in Tableau

- If you need to add a time component to your date field, you need to use `MAKEDATETIME()`
- **Time needed?** = `MAKEDATETIME()`
- **Date only?** = `MAKEDATE()`



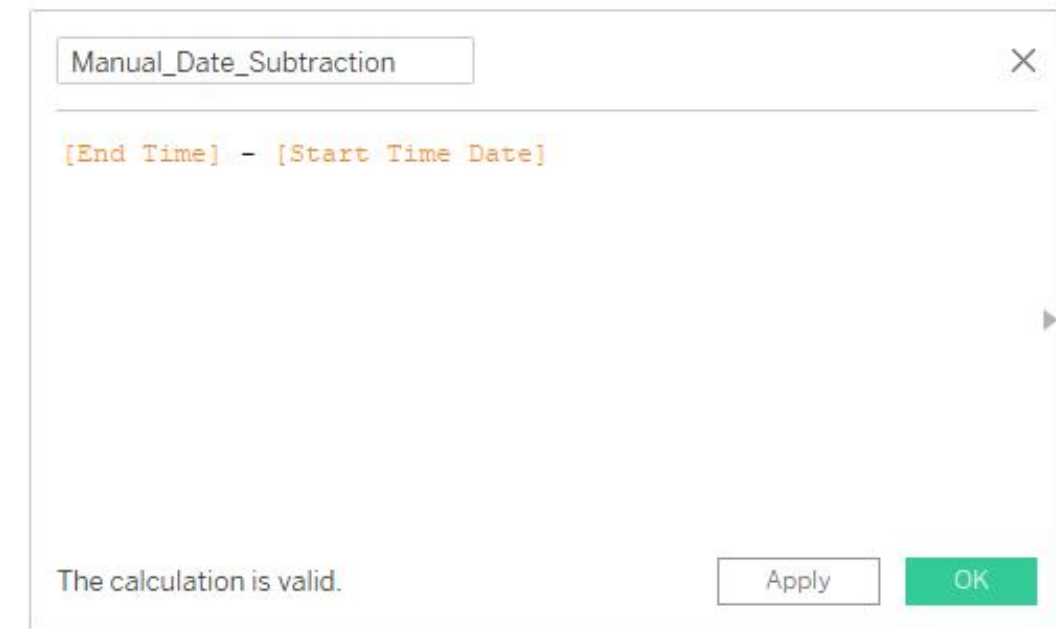
Date truncation in Tableau

- `DATETRUNC()` rounds your date field to the desired specificity
- `DATETRUNC()` returns the lowest value for each date part up to the date part specified as a date time object
- Useful for date preparation to showcase how measures changes over discrete time periods (e.g. Week on Week Growth)



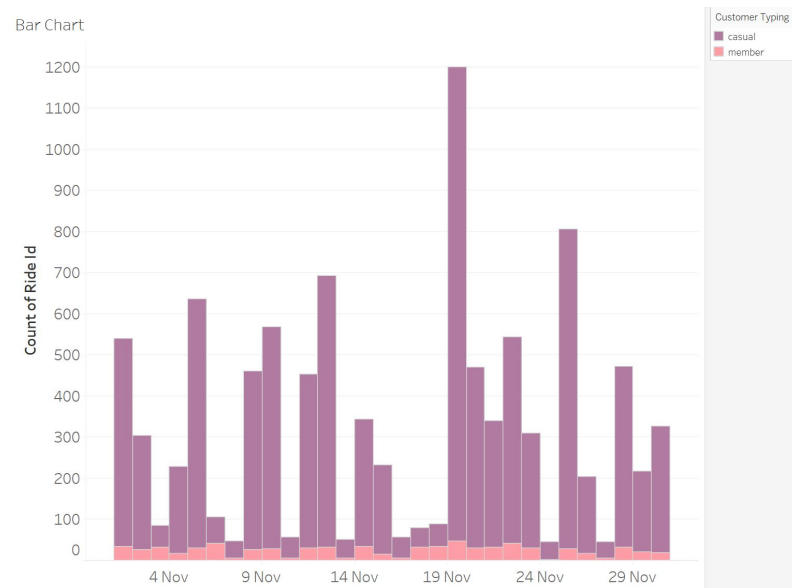
Calculations between date timestamps

- Dates can be subtracted using the syntax of `Date2 - Date1`, however, the result returned is in **days**
- This is not desirable as valuable time series information would be lost due to rounding
- `DATEDIFF()` returns the amount of time between two time stamps based off the specificity provided (e.g. 'minute','hour' etc.)
- Best practice returns data at the *lowest granularity needed* where the results are adjusted as required

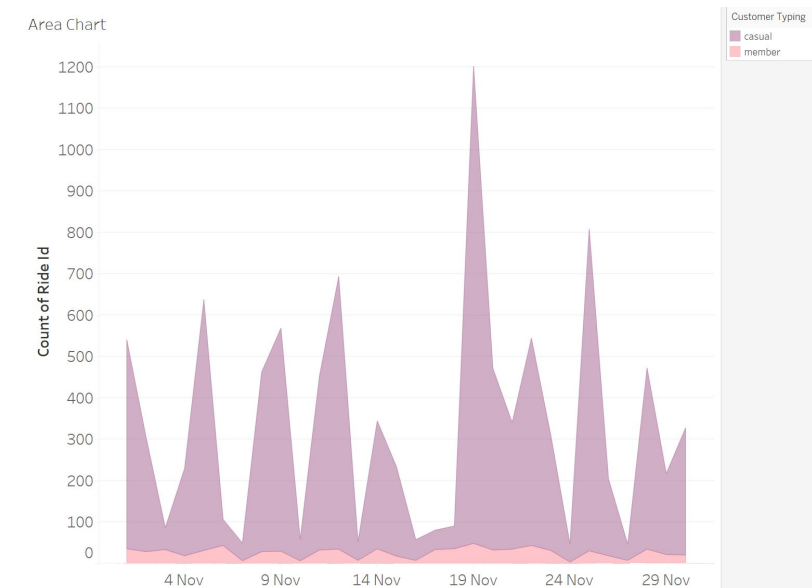


Visualizations with time series

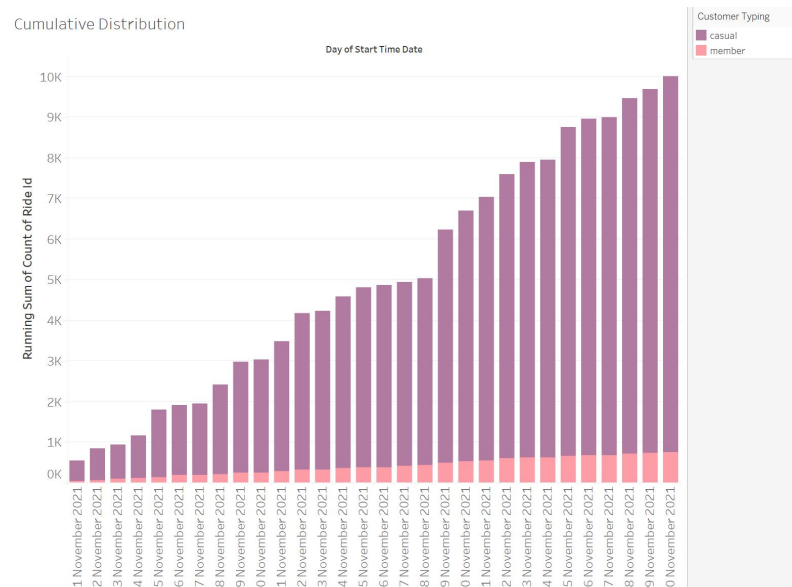
Bar charts



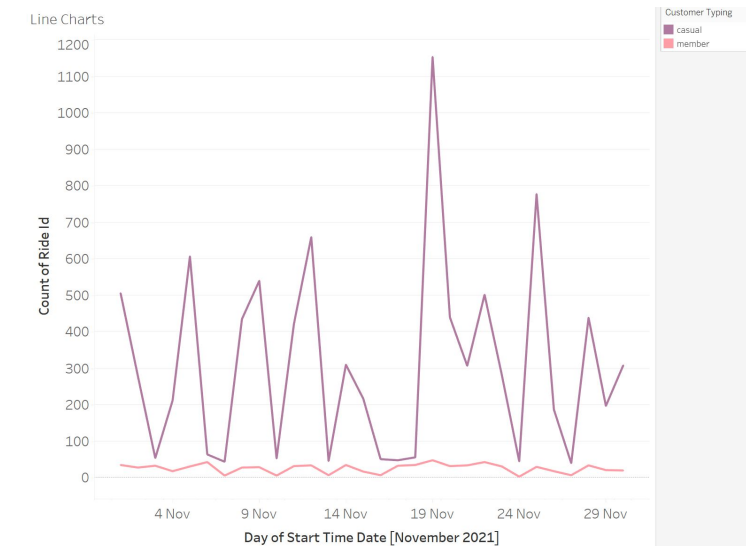
Area charts



Cumulative distributions



Line charts

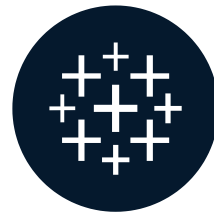


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Reformatting dates in Tableau

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