Google Data Analytics Capstone: Cyclistic Bike-Share Analysis Case Study

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This is a case study for the **Google Data Analytics Professional Certificate.** The project provides the Cyclistic Datasets for the learners to follow the steps of data analysis process: **ask, prepare, process, analyze, share and act** in order to answer the key business problems.

Phrase 1: Ask

In this phase, I need to do two things. I define the problem to be solved and I make sure that I fully understand stakeholder expectations.

About the company

The direct of the marking team Lily Moreno believes that maximizing the number of annual members will be key to future growth. Rather than creating a marketing campaign that targets all-new customers, Moreno believes there is a very good chance to convert casual riders into members. Moreno has set a clear goal: Design marketing strategies aimed at converting casual riders into annual members.

###Business Task Analyze the most recent 12 month Cyclistic Customer Data **(from 10/2020 to 09/2021)** in order to anslr the key questions:

1. How do annual members and casual riders use Cyclistic bikes differently?
2. Why would casual riders buy Cyclistic annual memberships?
3. How can Cyclistic use digital media to influence casual riders to become members?

Key Stakeholders:

Cyclistic executive team, Lily Moreno: The director of marketing and my manager.

Phrase 2: Prepare

This is where the data analysts collect and store data so later I will use for the upcoming analysis process. In this phrase, I will learn more about the different types of data and how to identify which kinds of data are most useful for solving a particular problem.

Import libraries

```
#helps wrangle data
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.4     v dplyr   1.0.7
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   2.0.1     v forcats 0.5.1
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
#helps wrangle date attributes
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
#helps visualize data
library(ggplot2)
```

Step 1: Load datasets

Upload Divvy datasets (csv files) here.

```
d10_2020 <- read_csv("202010-divvy-tripdata.csv")
```

```
## Rows: 388653 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (5): ride_id, rideable_type, start_station_name, end_station_name, memb...
## dbl  (6): start_station_id, end_station_id, start_lat, start_lng, end_lat, e...
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d11_2020 <- read_csv("202011-divvy-tripdata.csv")
```

```
## Rows: 259716 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (5): ride_id, rideable_type, start_station_name, end_station_name, memb...
## dbl  (6): start_station_id, end_station_id, start_lat, start_lng, end_lat, e...
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d12_2020 <- read_csv("202012-divvy-tripdata.csv")
```

```
## Rows: 131573 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d01_2021 <- read_csv("202101-divvy-tripdata.csv")
```

```
## Rows: 96834 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d02_2021 <- read_csv("202102-divvy-tripdata.csv")
```

```
## Rows: 49622 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d03_2021 <- read_csv("202103-divvy-tripdata.csv")
```

```
## Rows: 228496 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d04_2021 <- read_csv("202104-divvy-tripdata.csv")
```

```
## Rows: 337230 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d05_2021 <- read_csv("202105-divvy-tripdata.csv")
```

```
## Rows: 531633 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d06_2021 <- read_csv("202106-divvy-tripdata.csv")
```

```
## Rows: 729595 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d07_2021 <- read_csv("202107-divvy-tripdata.csv")
```

```
## Rows: 822410 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d08_2021 <- read_csv("202108-divvy-tripdata.csv")
```

```
## Rows: 804352 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
d09_2021 <- read_csv("202109-divvy-tripdata.csv")
```

```
## Rows: 756147 Columns: 13
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (7): ride_id, rideable_type, start_station_name, start_station_id, end_...
## dbl  (4): start_lat, start_lng, end_lat, end_lng
## dttm (2): started_at, ended_at
```

```
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

Step 2: Wrangle data and combine into a single file

Compare column names each of the files

As all names are already consistent - they do not need to be renamed.

```
colnames(d10_2020)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d11_2020)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d12_2020)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d01_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d02_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d03_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d04_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d05_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d06_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d07_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d08_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(d09_2021)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

Inspect the dataframes and look for incongruencies

```
str(d10_2020)
```

```
## spec_tbl_df [388,653 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:388653] "ACB6B40CF5B9044C" "DF450C72FD109C01" "B6396B54A15AC0DF" "44A4AEE261B9E8
54" ...
##  $ rideable_type     : chr [1:388653] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:388653], format: "2020-10-31 19:39:43" "2020-10-31 23:50:08" ...
##  $ ended_at          : POSIXct[1:388653], format: "2020-10-31 19:57:12" "2020-11-01 00:04:16" ...
##  $ start_station_name: chr [1:388653] "Lakeview Ave & Fullerton Pkwy" "Southport Ave & Waveland Ave" "Stony Is
land Ave & 67th St" "Clark St & Grace St" ...
##  $ start_station_id  : num [1:388653] 313 227 102 165 190 359 313 125 NA 174 ...
##  $ end_station_name  : chr [1:388653] "Rush St & Hubbard St" "Kedzie Ave & Milwaukee Ave" "University Ave & 57
th St" "Broadway & Sheridan Rd" ...
##  $ end_station_id    : num [1:388653] 125 260 423 256 185 53 125 313 199 635 ...
##  $ start_lat         : num [1:388653] 41.9 41.9 41.8 42 41.9 ...
##  $ start_lng         : num [1:388653] -87.6 -87.7 -87.6 -87.7 -87.7 ...
##  $ end_lat           : num [1:388653] 41.9 41.9 41.8 42 41.9 ...
##  $ end_lng           : num [1:388653] -87.6 -87.7 -87.6 -87.7 -87.7 ...
##  $ member_casual     : chr [1:388653] "casual" "casual" "casual" "casual" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d11_2020)
```

```
## spec_tbl_df [259,716 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:259716] "BD0A6FF6FFF9B921" "96A7A7A4BDE4F82D" "C61526D06582BDC5" "E533E89C32080B
9E" ...
##  $ rideable_type     : chr [1:259716] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:259716], format: "2020-11-01 13:36:00" "2020-11-01 10:03:26" ...
##  $ ended_at          : POSIXct[1:259716], format: "2020-11-01 13:45:40" "2020-11-01 10:14:45" ...
##  $ start_station_name: chr [1:259716] "Dearborn St & Erie St" "Franklin St & Illinois St" "Lake Shore Dr & Mon
roe St" "Leavitt St & Chicago Ave" ...
##  $ start_station_id  : num [1:259716] 110 672 76 659 2 72 76 NA 58 394 ...
##  $ end_station_name  : chr [1:259716] "St. Clair St & Erie St" "Noble St & Milwaukee Ave" "Federal St & Polk S
t" "Stave St & Armitage Ave" ...
##  $ end_station_id    : num [1:259716] 211 29 41 185 2 76 72 NA 288 273 ...
##  $ start_lat         : num [1:259716] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:259716] -87.6 -87.6 -87.6 -87.7 -87.6 ...
##  $ end_lat           : num [1:259716] 41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:259716] -87.6 -87.7 -87.6 -87.7 -87.6 ...
##  $ member_casual     : chr [1:259716] "casual" "casual" "casual" "casual" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d12_2020)
```

```
## spec_tbl_df [131,573 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:131573] "70B6A9A437D4C30D" "158A465D4E74C54A" "5262016E0F1F2F9A" "BE119628E44F87
1E" ...
##  $ rideable_type     : chr [1:131573] "classic_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:131573], format: "2020-12-27 12:44:29" "2020-12-18 17:37:15" ...
##  $ ended_at          : POSIXct[1:131573], format: "2020-12-27 12:55:06" "2020-12-18 17:44:19" ...
##  $ start_station_name: chr [1:131573] "Aberdeen St & Jackson Blvd" NA NA NA ...
##  $ start_station_id  : chr [1:131573] "13157" NA NA NA ...
##  $ end_station_name  : chr [1:131573] "Desplaines St & Kinzie St" NA NA NA ...
##  $ end_station_id    : chr [1:131573] "TA1306000003" NA NA NA ...
##  $ start_lat         : num [1:131573] 41.9 41.9 41.9 41.9 41.8 ...
##  $ start_lng         : num [1:131573] -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ end_lat           : num [1:131573] 41.9 41.9 41.9 41.9 41.8 ...
##  $ end_lng           : num [1:131573] -87.6 -87.7 -87.7 -87.7 -87.6 ...
##  $ member_casual     : chr [1:131573] "member" "member" "member" "member" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d01_2021)
```

```
## spec_tbl_df [96,834 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:96834] "E19E6F1B8D4C42ED" "DC88F20C2C55F27F" "EC45C94683FE3F27" "4FA453A75AE377D
B" ...
##  $ rideable_type     : chr [1:96834] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:96834], format: "2021-01-23 16:14:19" "2021-01-27 18:43:08" ...
##  $ ended_at          : POSIXct[1:96834], format: "2021-01-23 16:24:44" "2021-01-27 18:47:12" ...
##  $ start_station_name: chr [1:96834] "California Ave & Cortez St" "California Ave & Cortez St" "California Ave
& Cortez St" "California Ave & Cortez St" ...
##  $ start_station_id  : chr [1:96834] "17660" "17660" "17660" "17660" ...
##  $ end_station_name  : chr [1:96834] NA NA NA NA ...
##  $ end_station_id    : chr [1:96834] NA NA NA NA ...
##  $ start_lat         : num [1:96834] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:96834] -87.7 -87.7 -87.7 -87.7 -87.7 ...
##  $ end_lat           : num [1:96834] 41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:96834] -87.7 -87.7 -87.7 -87.7 -87.7 ...
##  $ member_casual     : chr [1:96834] "member" "member" "member" "member" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d02_2021)
```

```
## spec_tbl_df [49,622 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:49622] "89E7AA6C29227EFF" "0FEFDE2603568365" "E6159D746B2DBB91" "B32D3199F1C2E75
B" ...
##  $ rideable_type     : chr [1:49622] "classic_bike" "classic_bike" "electric_bike" "classic_bike" ...
##  $ started_at        : POSIXct[1:49622], format: "2021-02-12 16:14:56" "2021-02-14 17:52:38" ...
##  $ ended_at          : POSIXct[1:49622], format: "2021-02-12 16:21:43" "2021-02-14 18:12:09" ...
##  $ start_station_name: chr [1:49622] "Glenwood Ave & Touhy Ave" "Glenwood Ave & Touhy Ave" "Clark St & Lake St
" "Wood St & Chicago Ave" ...
##  $ start_station_id  : chr [1:49622] "525" "525" "KA1503000012" "637" ...
##  $ end_station_name  : chr [1:49622] "Sheridan Rd & Columbia Ave" "Bosworth Ave & Howard St" "State St & Rando
lph St" "Honore St & Division St" ...
##  $ end_station_id    : chr [1:49622] "660" "16806" "TA1305000029" "TA1305000034" ...
##  $ start_lat         : num [1:49622] 42 42 41.9 41.9 41.8 ...
##  $ start_lng         : num [1:49622] -87.7 -87.7 -87.6 -87.7 -87.6 ...
##  $ end_lat           : num [1:49622] 42 42 41.9 41.9 41.8 ...
##  $ end_lng           : num [1:49622] -87.7 -87.7 -87.6 -87.7 -87.6 ...
##  $ member_casual     : chr [1:49622] "member" "casual" "member" "member" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d03_2021)
```

```
## spec_tbl_df [228,496 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:228496] "CFA86D4455AA1030" "30D9DC61227D1AF3" "846D87A15682A284" "994D05AA75A168
F2" ...
##  $ rideable_type     : chr [1:228496] "classic_bike" "classic_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : POSIXct[1:228496], format: "2021-03-16 08:32:30" "2021-03-28 01:26:28" ...
##  $ ended_at          : POSIXct[1:228496], format: "2021-03-16 08:36:34" "2021-03-28 01:36:55" ...
##  $ start_station_name: chr [1:228496] "Humboldt Blvd & Armitage Ave" "Humboldt Blvd & Armitage Ave" "Shields A
ve & 28th Pl" "Winthrop Ave & Lawrence Ave" ...
##  $ start_station_id  : chr [1:228496] "15651" "15651" "15443" "TA1308000021" ...
##  $ end_station_name  : chr [1:228496] "Stave St & Armitage Ave" "Central Park Ave & Bloomingdale Ave" "Halsted
St & 35th St" "Broadway & Sheridan Rd" ...
##  $ end_station_id    : chr [1:228496] "13266" "18017" "TA1308000043" "13323" ...
##  $ start_lat         : num [1:228496] 41.9 41.9 41.8 42 42 ...
##  $ start_lng         : num [1:228496] -87.7 -87.7 -87.6 -87.7 -87.7 ...
##  $ end_lat           : num [1:228496] 41.9 41.9 41.8 42 42.1 ...
##  $ end_lng           : num [1:228496] -87.7 -87.7 -87.6 -87.6 -87.7 ...
##  $ member_casual     : chr [1:228496] "casual" "casual" "casual" "casual" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d04_2021)
```

```
## spec_tbl_df [337,230 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:337230] "6C992BD37A98A63F" "1E0145613A209000" "E498E15508A80BAD" "1887262AD101C6
04" ...
##  $ rideable_type     : chr [1:337230] "classic_bike" "docked_bike" "docked_bike" "classic_bike" ...
##  $ started_at        : POSIXct[1:337230], format: "2021-04-12 18:25:36" "2021-04-27 17:27:11" ...
##  $ ended_at          : POSIXct[1:337230], format: "2021-04-12 18:56:55" "2021-04-27 18:31:29" ...
##  $ start_station_name: chr [1:337230] "State St & Pearson St" "Dorchester Ave & 49th St" "Loomis Blvd & 84th S
t" "Honore St & Division St" ...
##  $ start_station_id  : chr [1:337230] "TA1307000061" "KA1503000069" "20121" "TA1305000034" ...
##  $ end_station_name  : chr [1:337230] "Southport Ave & Waveland Ave" "Dorchester Ave & 49th St" "Loomis Blvd &
84th St" "Southport Ave & Waveland Ave" ...
##  $ end_station_id    : chr [1:337230] "13235" "KA1503000069" "20121" "13235" ...
##  $ start_lat         : num [1:337230] 41.9 41.8 41.7 41.9 41.7 ...
##  $ start_lng         : num [1:337230] -87.6 -87.6 -87.7 -87.7 -87.7 ...
##  $ end_lat           : num [1:337230] 41.9 41.8 41.7 41.9 41.7 ...
##  $ end_lng           : num [1:337230] -87.7 -87.6 -87.7 -87.7 -87.7 ...
##  $ member_casual     : chr [1:337230] "member" "casual" "casual" "member" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d05_2021)
```

```
## spec_tbl_df [531,633 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:531633] "C809ED75D6160B2A" "DD59FDCE0ACACAF3" "0AB83CB88C43EFC2" "7881AC6D39110C
60" ...
##  $ rideable_type     : chr [1:531633] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:531633], format: "2021-05-30 11:58:15" "2021-05-30 11:29:14" ...
##  $ ended_at          : POSIXct[1:531633], format: "2021-05-30 12:10:39" "2021-05-30 12:14:09" ...
##  $ start_station_name: chr [1:531633] NA NA NA NA ...
##  $ start_station_id  : chr [1:531633] NA NA NA NA ...
##  $ end_station_name  : chr [1:531633] NA NA NA NA ...
##  $ end_station_id    : chr [1:531633] NA NA NA NA ...
##  $ start_lat         : num [1:531633] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:531633] -87.6 -87.6 -87.7 -87.7 -87.7 ...
##  $ end_lat           : num [1:531633] 41.9 41.8 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:531633] -87.6 -87.6 -87.7 -87.7 -87.7 ...
##  $ member_casual     : chr [1:531633] "casual" "casual" "casual" "casual" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d06_2021)
```

```
## spec_tbl_df [729,595 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:729595] "99FEC93BA843FB20" "06048DCFC8520CAF" "9598066F68045DF2" "B03C0FE48C4122
14" ...
##  $ rideable_type     : chr [1:729595] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:729595], format: "2021-06-13 14:31:28" "2021-06-04 11:18:02" ...
##  $ ended_at          : POSIXct[1:729595], format: "2021-06-13 14:34:11" "2021-06-04 11:24:19" ...
##  $ start_station_name: chr [1:729595] NA NA NA NA ...
##  $ start_station_id  : chr [1:729595] NA NA NA NA ...
##  $ end_station_name  : chr [1:729595] NA NA NA NA ...
##  $ end_station_id    : chr [1:729595] NA NA NA NA ...
##  $ start_lat         : num [1:729595] 41.8 41.8 41.8 41.8 41.8 ...
##  $ start_lng         : num [1:729595] -87.6 -87.6 -87.6 -87.6 -87.6 ...
##  $ end_lat           : num [1:729595] 41.8 41.8 41.8 41.8 41.8 ...
##  $ end_lng           : num [1:729595] -87.6 -87.6 -87.6 -87.6 -87.6 ...
##  $ member_casual     : chr [1:729595] "member" "member" "member" "member" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d07_2021)
```

```
## spec_tbl_df [822,410 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:822410] "0A1B623926EF4E16" "B2D5583A5A5E76EE" "6F264597DDBF427A" "379B58EAB20E8A
A5" ...
##  $ rideable_type     : chr [1:822410] "docked_bike" "classic_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : POSIXct[1:822410], format: "2021-07-02 14:44:36" "2021-07-07 16:57:42" ...
##  $ ended_at          : POSIXct[1:822410], format: "2021-07-02 15:19:58" "2021-07-07 17:16:09" ...
##  $ start_station_name: chr [1:822410] "Michigan Ave & Washington St" "California Ave & Cortez St" "Wabash Ave
& 16th St" "California Ave & Cortez St" ...
##  $ start_station_id  : chr [1:822410] "13001" "17660" "SL-012" "17660" ...
##  $ end_station_name  : chr [1:822410] "Halsted St & North Branch St" "Wood St & Hubbard St" "Rush St & Hubbard
St" "Carpenter St & Huron St" ...
##  $ end_station_id    : chr [1:822410] "KA1504000117" "13432" "KA1503000044" "13196" ...
##  $ start_lat         : num [1:822410] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:822410] -87.6 -87.7 -87.6 -87.7 -87.7 ...
##  $ end_lat           : num [1:822410] 41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:822410] -87.6 -87.7 -87.6 -87.7 -87.7 ...
##  $ member_casual     : chr [1:822410] "casual" "casual" "member" "member" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d08_2021)
```

```
## spec_tbl_df [804,352 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:804352] "99103BB87CC6C1BB" "EAFCCCFB0A3FC5A1" "9EF4F46C57AD234D" "5834D3208BFAF1
DA" ...
##  $ rideable_type     : chr [1:804352] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:804352], format: "2021-08-10 17:15:49" "2021-08-10 17:23:14" ...
##  $ ended_at          : POSIXct[1:804352], format: "2021-08-10 17:22:44" "2021-08-10 17:39:24" ...
##  $ start_station_name: chr [1:804352] NA NA NA NA ...
##  $ start_station_id  : chr [1:804352] NA NA NA NA ...
##  $ end_station_name  : chr [1:804352] NA NA NA NA ...
##  $ end_station_id    : chr [1:804352] NA NA NA NA ...
##  $ start_lat         : num [1:804352] 41.8 41.8 42 42 41.8 ...
##  $ start_lng         : num [1:804352] -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ end_lat           : num [1:804352] 41.8 41.8 42 42 41.8 ...
##  $ end_lng           : num [1:804352] -87.7 -87.6 -87.7 -87.7 -87.6 ...
##  $ member_casual     : chr [1:804352] "member" "member" "member" "member" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(d09_2021)
```

```
## spec_tbl_df [756,147 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:756147] "9DC7B962304CBFD8" "F930E2C6872D6B32" "6EF72137900BB910" "78D1DE133B3DBF
55" ...
##  $ rideable_type     : chr [1:756147] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:756147], format: "2021-09-28 16:07:10" "2021-09-28 14:24:51" ...
##  $ ended_at          : POSIXct[1:756147], format: "2021-09-28 16:09:54" "2021-09-28 14:40:05" ...
##  $ start_station_name: chr [1:756147] NA NA NA NA ...
##  $ start_station_id  : chr [1:756147] NA NA NA NA ...
##  $ end_station_name  : chr [1:756147] NA NA NA NA ...
##  $ end_station_id    : chr [1:756147] NA NA NA NA ...
##  $ start_lat         : num [1:756147] 41.9 41.9 41.8 41.8 41.9 ...
##  $ start_lng         : num [1:756147] -87.7 -87.6 -87.7 -87.7 -87.7 ...
##  $ end_lat           : num [1:756147] 41.9 42 41.8 41.8 41.9 ...
##  $ end_lng           : num [1:756147] -87.7 -87.7 -87.7 -87.7 -87.7 ...
##  $ member_casual     : chr [1:756147] "casual" "casual" "casual" "casual" ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

Inspect the dataframes and look for incongruencies

After the above comparison, I need to convert **start_station_id** to character so I can perform calculations correctly later on.

```
d10_2020 <-  mutate(d10_2020, start_station_id = as.character(start_station_id)
                            ,end_station_id = as.character(end_station_id))
d11_2020 <-  mutate(d11_2020, start_station_id = as.character(start_station_id)
                            ,end_station_id = as.character(end_station_id))
```

Stack individual quarter's data frames into one big data frame

```
all_trips <- bind_rows(d10_2020, d11_2020, d12_2020, d01_2021, d02_2021, d03_2021, d04_2021, d05_2021, d06_2021,
d07_2021, d08_2021, d09_2021)
```

Remove start_lat, start_lng, end_lat, end_lng fields as this data was dropped beginning in 2020

```
all_trips <- all_trips %>%
  select(-c(start_lat,start_lng,end_lat,end_lng))
colnames(all_trips)
```

```
## [1] "ride_id"            "rideable_type"      "started_at"
## [4] "ended_at"           "start_station_name" "start_station_id"
## [7] "end_station_name"   "end_station_id"     "member_casual"
```

Phrase 3: Process

A process known as data cleaning is the fixing or removing incorrect, corrupted, incorrectly formatted, duplicate, or incomplete data within a dataset. What I aim to achieve is clean data.

Step 3: Clean up and add data to prepare for analysis

Inspect the new table that has been created

```
#List of column names
colnames(all_trips)
```

```
## [1] "ride_id"            "rideable_type"      "started_at"
## [4] "ended_at"           "start_station_name" "start_station_id"
## [7] "end_station_name"   "end_station_id"     "member_casual"
```

```
#How many rows are in data frame?
nrow(all_trips)
```

```
## [1] 5136261
```

```
#Dimensions of the data frame?
dim(all_trips)
```

```
## [1] 5136261       9
```

```
#See the first 6 rows of data frame.  Also tail(all_trips)
head(all_trips)
```

ride_id <chr>
ACB6B40CF5B9044C
DF450C72FD109C01
B6396B54A15AC0DF
44A4AEE261B9E854
10B7DD76A6A2EB95
DA6C3759660133DA

6 rows | 1-1 of 9 columns

```
#See list of columns and data types (numeric, character, etc)
str(all_trips)
```

```
## tibble [5,136,261 x 9] (S3: tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:5136261] "ACB6B40CF5B9044C" "DF450C72FD109C01" "B6396B54A15AC0DF" "44A4AEE261B9E
854" ...
##  $ rideable_type     : chr [1:5136261] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:5136261], format: "2020-10-31 19:39:43" "2020-10-31 23:50:08" ...
##  $ ended_at          : POSIXct[1:5136261], format: "2020-10-31 19:57:12" "2020-11-01 00:04:16" ...
##  $ start_station_name: chr [1:5136261] "Lakeview Ave & Fullerton Pkwy" "Southport Ave & Waveland Ave" "Stony I
sland Ave & 67th St" "Clark St & Grace St" ...
##  $ start_station_id  : chr [1:5136261] "313" "227" "102" "165" ...
##  $ end_station_name  : chr [1:5136261] "Rush St & Hubbard St" "Kedzie Ave & Milwaukee Ave" "University Ave & 5
7th St" "Broadway & Sheridan Rd" ...
##  $ end_station_id    : chr [1:5136261] "125" "260" "423" "256" ...
##  $ member_casual     : chr [1:5136261] "casual" "casual" "casual" "casual" ...
```

```
#Statistical summary of data. Mainly for numberics
summary(all_trips)
```

```
##    ride_id          rideable_type        started_at
##  Length:5136261     Length:5136261     Min.   :2020-10-01 00:00:06
##  Class :character   Class :character   1st Qu.:2021-04-11 18:50:57
##  Mode  :character   Mode  :character   Median :2021-06-21 18:01:31
##                                        Mean   :2021-05-25 22:30:57
##                                        3rd Qu.:2021-08-11 21:13:51
##                                        Max.   :2021-09-30 23:59:48
##     ended_at                   start_station_name start_station_id
##  Min.   :2020-10-01 00:05:09   Length:5136261     Length:5136261
##  1st Qu.:2021-04-11 19:15:05   Class :character   Class :character
##  Median :2021-06-21 18:20:59   Mode  :character   Mode  :character
##  Mean   :2021-05-25 22:51:34
##  3rd Qu.:2021-08-11 21:33:57
##  Max.   :2021-10-01 22:55:35
##  end_station_name   end_station_id     member_casual
##  Length:5136261     Length:5136261     Length:5136261
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
```

Remove inconsistency

There are four unique values in member_casual subscriber, member, customer, casual but 2020 on wards these member has been changed into two unique values that are member, casual.

```
table(all_trips$member_casual)
```

```
##
##  casual  member
## 2358287 2777974
```

```
all_trips <-  all_trips %>%
  mutate(member_casual = recode(member_casual
                                ,"Subscriber" = "member"
                                ,"Customer" = "Casual"))
table(all_trips$member_casual)
```

```
##
##  casual  member
## 2358287 2777974
```

Day (Add new columns)

Add columns that list the date, month, day, and year of each ride. This will allow us to aggregate ride data for each month, day, or year … before completing these operations I could only aggregate at the ride level.

```
#The default format is yyyy-mm-dd
all_trips$date <- as.Date(all_trips$started_at)
all_trips$month <- format(as.Date(all_trips$date), "%m")
all_trips$day <- format(as.Date(all_trips$date), "%d")
all_trips$year <- format(as.Date(all_trips$date), "%Y")
all_trips$day_of_Iek <- format(as.Date(all_trips$date), "%A")
```

Ride length (Add new column)

ride_length is the distance betlen started time and ended time.

```
# Add a "ride_length" calculation to all_trips (in minutes)
all_trips$ride_length <- difftime(all_trips$ended_at,all_trips$started_at,units = "mins")
head(all_trips$ride_length)
```

```
## Time differences in mins
## [1] 17.483333 14.133333  8.350000  2.866667 16.216667  7.650000
```

```
# Inspect the structure of the columns
str(all_trips)
```

```
## tibble [5,136,261 x 15] (S3: tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:5136261] "ACB6B40CF5B9044C" "DF450C72FD109C01" "B6396B54A15AC0DF" "44A4AEE261B9E
854" ...
##  $ rideable_type     : chr [1:5136261] "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:5136261], format: "2020-10-31 19:39:43" "2020-10-31 23:50:08" ...
##  $ ended_at          : POSIXct[1:5136261], format: "2020-10-31 19:57:12" "2020-11-01 00:04:16" ...
##  $ start_station_name: chr [1:5136261] "Lakeview Ave & Fullerton Pkwy" "Southport Ave & Waveland Ave" "Stony I
sland Ave & 67th St" "Clark St & Grace St" ...
##  $ start_station_id  : chr [1:5136261] "313" "227" "102" "165" ...
##  $ end_station_name  : chr [1:5136261] "Rush St & Hubbard St" "Kedzie Ave & Milwaukee Ave" "University Ave & 5
7th St" "Broadway & Sheridan Rd" ...
##  $ end_station_id    : chr [1:5136261] "125" "260" "423" "256" ...
##  $ member_casual     : chr [1:5136261] "casual" "casual" "casual" "casual" ...
##  $ date              : Date[1:5136261], format: "2020-10-31" "2020-10-31" ...
##  $ month             : chr [1:5136261] "10" "10" "10" "10" ...
##  $ day               : chr [1:5136261] "31" "31" "31" "31" ...
##  $ year              : chr [1:5136261] "2020" "2020" "2020" "2020" ...
##  $ day_of_Iek        : chr [1:5136261] "Saturday" "Saturday" "Saturday" "Saturday" ...
##  $ ride_length       : 'difftime' num [1:5136261] 17.4833333333333 14.1333333333333 8.35 2.86666666666667 ...
##   ..- attr(*, "units")= chr "mins"
```

```
# Convert "ride_length" from Factor to numeric so I can run calculations on the data
is.factor(all_trips$ride_length)
```

```
## [1] FALSE
```

```
all_trips$ride_length <- as.numeric(as.character(all_trips$ride_length))
is.numeric(all_trips$ride_length)
```

```
## [1] TRUE
```

```
# Remove "bad" data
# The dataframe includes a few hundred entries when bikes Ire taken out of docks and checked for quality by Divvy
or ride_length was negative
# I will create a new version of the dataframe (v2) since data is being removed
all_trips_v2 <- all_trips[!(all_trips$start_station_name == "HQ QR" | all_trips$ride_length<0),]
```

Remove NA

Remove the missing values in the dataset.

```
#Check the missing values in the dataset.
colSums(is.na(all_trips_v2))
```

```
##            ride_id      rideable_type         started_at           ended_at
##             523409             523409             523409             523409
## start_station_name   start_station_id   end_station_name     end_station_id
##             523409             523726             781675             781869
##      member_casual               date              month                day
##             523409             523409             523409             523409
##               year         day_of_Iek        ride_length
##             523409             523409             523409
```

```
#Remove NA
all_trips_v3 <- all_trips_v2[!(is.na(all_trips_v2$start_station_id) | is.na(all_trips_v2$end_station_id) | is.na(
all_trips_v2$member_casual) | is.na(all_trips_v2$end_station_name)),]
table(all_trips_v3$member_casual)
```

```
##
##  casual  member
## 1963854 2386998
```

```
#Check again for the missing values in the dataset.
colSums(is.na(all_trips_v3))
```

```
##            ride_id      rideable_type         started_at           ended_at
##                  0                  0                  0                  0
## start_station_name   start_station_id   end_station_name     end_station_id
##                  0                  0                  0                  0
##      member_casual               date              month                day
##                  0                  0                  0                  0
##               year        day_of_Iek        ride_length
##                  0                  0                  0
```

Phrase 4: Analyze

Analyzing the data I've collected involves using tools to transform and organize that information so that I can draw useful conclusions, make predictions, and drive informed decision-making.

Conduct Descriptive analysis

Firstly, I need to look at the basic descriptive statistics of the data.

```
# Statistic summary of ride length in minutes
summary(all_trips_v3$ride_length)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##     0.00     7.22    12.70    22.65    22.98 55944.15
```

```
# Compare members and casual users
aggregate(all_trips_v3$ride_length ~ all_trips_v3$member_casual, FUN = mean)
```

all_trips_v3$member_casual <chr>
casual
member

2 rows | 1-1 of 2 columns

```
aggregate(all_trips_v3$ride_length ~ all_trips_v3$member_casual, FUN = median)
```

all_trips_v3$member_casual <chr>
casual
member

2 rows | 1-1 of 2 columns

```
aggregate(all_trips_v3$ride_length ~ all_trips_v3$member_casual, FUN = max)
```

all_trips_v3$member_casual <chr>
casual
member

2 rows | 1-1 of 2 columns

```
aggregate(all_trips_v3$ride_length ~ all_trips_v3$member_casual, FUN = min)
```

all_trips_v3$member_casual <chr>
casual
member

2 rows | 1-1 of 2 columns

Notice that the days of the week are out of order. Let's fix that.

```
all_trips_v3$day_of_Iek <- ordered(all_trips_v3$day_of_Iek, levels=c("Sunday", "Monday", "Tuesday", "Idnesday", "
Thursday", "Friday", "Saturday"))
```

Now, let's run the average ride time by each day for members vs casual users.

```
aggregate(all_trips_v3$ride_length ~ all_trips_v3$member_casual + all_trips_v3$day_of_Iek, FUN = mean)
```

all_trips_v3$member_casual <chr>
casual
member
casual
member
casual
member
casual
member
casual
member

1-10 of 12 rows | 1-1 of 3 columns Previous **1** 2 Next

The I will look at the total number of rides and the average ride duration (in seconds) by weekday for casual customers and members.

```
# analyze ridership data by type and Iekday
all_trips_v3 %>%
#creates Iekday field using wday()
  mutate(Iekday = wday(started_at, label = TRUE)) %>%
#groups by usertype and Iekday
  group_by(member_casual, Iekday) %>%
#calculates the number of rides and average duration
  summarise(number_of_rides = n()
#calculates the average duration
  ,average_duration = mean(ride_length)) %>%
#sorts
  arrange(member_casual, Iekday)
```

```
## `summarise()` has grouped output by 'member_casual'. You can override using the `.groups` argument.
```

member_casual <chr>
casual
casual
casual
casual
casual
casual
casual
member
member
member

1-10 of 14 rows | 1-1 of 4 columns Previous **1** 2 Next

Phrase 5: Share

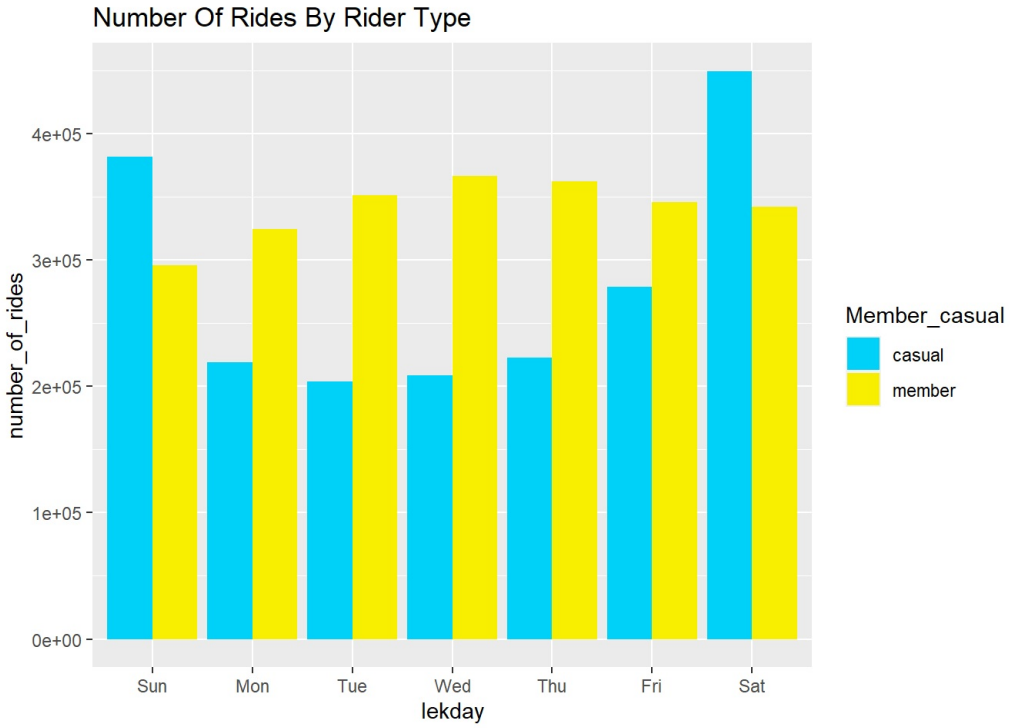
Here I learn how data analysts interpret results and share them with others to help stakeholders make effective data-driven decisions. In the share phase, visualization is a data analyst's best friend.

Visualization 1: Total number of rides by rider type

Let's visualize the number of rides by rider type.

```
all_trips_v3 %>%
  mutate(Iekday = wday(started_at, label = TRUE)) %>%
  group_by(member_casual, Iekday) %>%
  summarise(number_of_rides = n(),average_duration = mean(ride_length)) %>%
  arrange(member_casual, Iekday)  %>%
  ggplot(aes(x = Iekday, y = number_of_rides, fill = member_casual)) + geom_col(position = "dodge") +
  scale_fill_manual("Member_casual",values = c('#00D1F8', '#F8EF00'))+
  ggtitle( "Number Of Rides By Rider Type")
```

```
## `summarise()` has grouped output by 'member_casual'. You can override using the `.groups` argument.
```

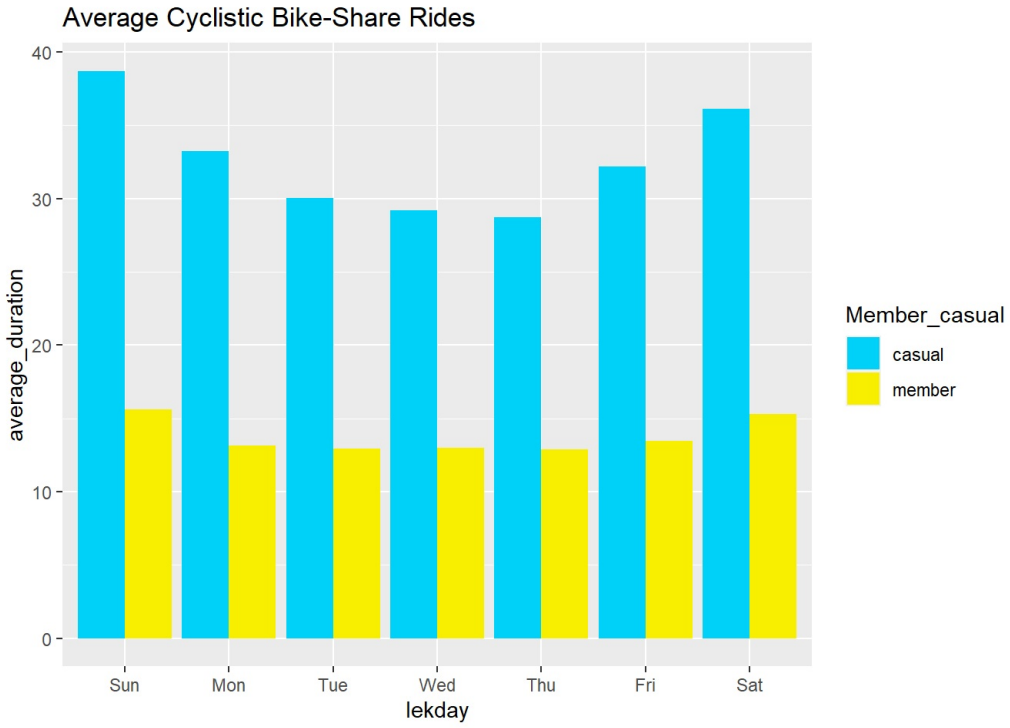


Visualization 2: Average Cyclistic Bike-Share Rides

Let's create a visualization for average duration.

```
  all_trips_v3 %>%
    mutate(Iekday = wday(started_at, label = TRUE)) %>%
    group_by(member_casual, Iekday) %>%
    summarise(number_of_rides = n()
              ,average_duration = mean(ride_length)) %>%
    arrange(member_casual, Iekday)  %>%
    ggplot(aes(x = Iekday, y = average_duration, fill = member_casual)) +
    geom_col(position = "dodge")+
    scale_fill_manual("Member_casual",values = c('#00D1F8', '#F8EF00'))+
    ggtitle( "Average Cyclistic Bike-Share Rides")
```

```
## `summarise()` has grouped output by 'member_casual'. You can override using the `.groups` argument.
```



Export summary file for further analysis

Exported the data as a csv file.

```
  # Create a csv file that I will visualize in Excel, Tableau, or my presentation software
  counts <- aggregate(all_trips_v3$ride_length ~ all_trips_v3$member_casual + all_trips_v3$day_of_Iek, FUN = mean
)
  write.csv(counts, file = 'avg_ride_length.csv')
```

Phrase 6: ACT

Now, I know the problem, Let's solve it! This is the phase where I need carefully go through our data problem and the analysis I made to make a data-driven decision.

Key Findings

Based on the "Number of Rides By Rider Type" graph, we can see that members usually use bike on weekdays while the casual members mostly use bike during their weekend. It can be explained that the members use bike to commute to work on the daily basic while the casual members just just bike for their leisure on the weekend.

According to the "Average Cyclistic Bike-Share Rides" graph, we also see that casual members usually use bike for a longer period of time while members consistently use bike for a shorter time.

Recommendations

1. Charge higher price for non-members during the weekends in order to encourage the casual members to sign up for membership.
2. Change the pricing system as follows:

- Limiting the hours for the non-members during weekends.
- Allow annual members to use bike for the higher duration compared to the non-members.

By following these recommendations, the Cyclistic can convert more casual members into the annual members.