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

Trang Vu

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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 ansIr 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" "44A4AEE261B9E854" ...
##  $ 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 Island 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 & 57th 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" "E533E89C32080B9E" ...
##  $ 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 & Monroe 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 St" "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" "BE119628E44F871E" ...
##  $ 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" "4FA453A75AE377DB" ...
##  $ 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" "B32D3199F1C2E75B" ...
##  $ 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 & Randolph 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" "994D05AA75A168F2" ...
##  $ 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 Ave & 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" "1887262AD101C604" ...
##  $ 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 St" "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" "7881AC6D39110C60" ...
##  $ 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" "B03C0FE48C412214" ...
##  $ 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" "379B58EAB20E8AA5" ...
##  $ 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" "5834D3208BFAF1DA" ...
```

```
##  $ 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" "78D1DE133B3DBF55" ...
##  $ 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)

## # A tibble: 6 x 9
##   ride_id          rideable_type started_at          ended_at
start_station_n~
##   <chr>            <chr>         <dttm>              <dttm>
<chr>
## 1 ACB6B40CF5B9044C electric_bike 2020-10-31 19:39:43 2020-10-31 19:57:12
Lakeview Ave & ~
## 2 DF450C72FD109C01 electric_bike 2020-10-31 23:50:08 2020-11-01 00:04:16
Southport Ave &~
## 3 B6396B54A15AC0DF electric_bike 2020-10-31 23:00:01 2020-10-31 23:08:22
Stony Island Av~
## 4 44A4AEE261B9E854 electric_bike 2020-10-31 22:16:43 2020-10-31 22:19:35
Clark St & Grac~
## 5 10B7DD76A6A2EB95 electric_bike 2020-10-31 19:38:19 2020-10-31 19:54:32
Southport Ave &~
## 6 DA6C3759660133DA electric_bike 2020-10-29 17:38:04 2020-10-29 17:45:43
Larrabee St & D~
## # ... with 4 more variables: start_station_id <chr>, end_station_name
<chr>,
## #   end_station_id <chr>, member_casual <chr>
```

```
#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" "44A4AEE261B9E854" ...
##  $ 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 Island 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 & 57th 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 betIen 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" "44A4AEE261B9E854" ...
##  $ rideable_type     : chr [1:5136261] "electric_bike" "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 Island 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 & 57th 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$member_casual all_trips_v3$ride_length
## 1                     casual                 33.53884
## 2                     member                 13.69834

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

##   all_trips_v3$member_casual all_trips_v3$ride_length
## 1                     casual                 17.21667
## 2                     member                 10.10000

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

##   all_trips_v3$member_casual all_trips_v3$ride_length
## 1                     casual                55944.150
## 2                     member                 9557.783

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

##   all_trips_v3$member_casual all_trips_v3$ride_length
## 1                     casual                        0
## 2                     member                        0
```

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$member_casual all_trips_v3$day_of_Iek
all_trips_v3$ride_length
## 1                      casual                  Sunday
38.70834
## 2                      member                  Sunday
15.60229
```

```
## 3                      casual                   Monday
33.21210
## 4                      member                   Monday
13.12929
## 5                      casual                  Tuesday
30.04368
## 6                      member                  Tuesday
12.91608
## 7                      casual                 Thursday
28.72698
## 8                      member                 Thursday
12.85460
## 9                      casual                   Friday
32.19319
## 10                     member                   Friday
13.48139
## 11                     casual                 Saturday
36.11778
## 12                     member                 Saturday
15.29243
```

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.
```

```
## # A tibble: 14 x 4
## # Groups:   member_casual [2]
##    member_casual Iekday number_of_rides average_duration
##    <chr>         <ord>            <int>            <dbl>
##  1 casual        Sun             381835             38.7
##  2 casual        Mon             219108             33.2
##  3 casual        Tue             203614             30.0
##  4 casual        Wed             208591             29.2
##  5 casual        Thu             222586             28.7
##  6 casual        Fri             278733             32.2
##  7 casual        Sat             449387             36.1
```

```
##  8 member        Sun             295652             15.6
##  9 member        Mon             324052             13.1
## 10 member        Tue             351349             12.9
## 11 member        Wed             366060             13.0
## 12 member        Thu             362061             12.9
## 13 member        Fri             345858             13.5
## 14 member        Sat             341966             15.3
```

Phrase 5: Share

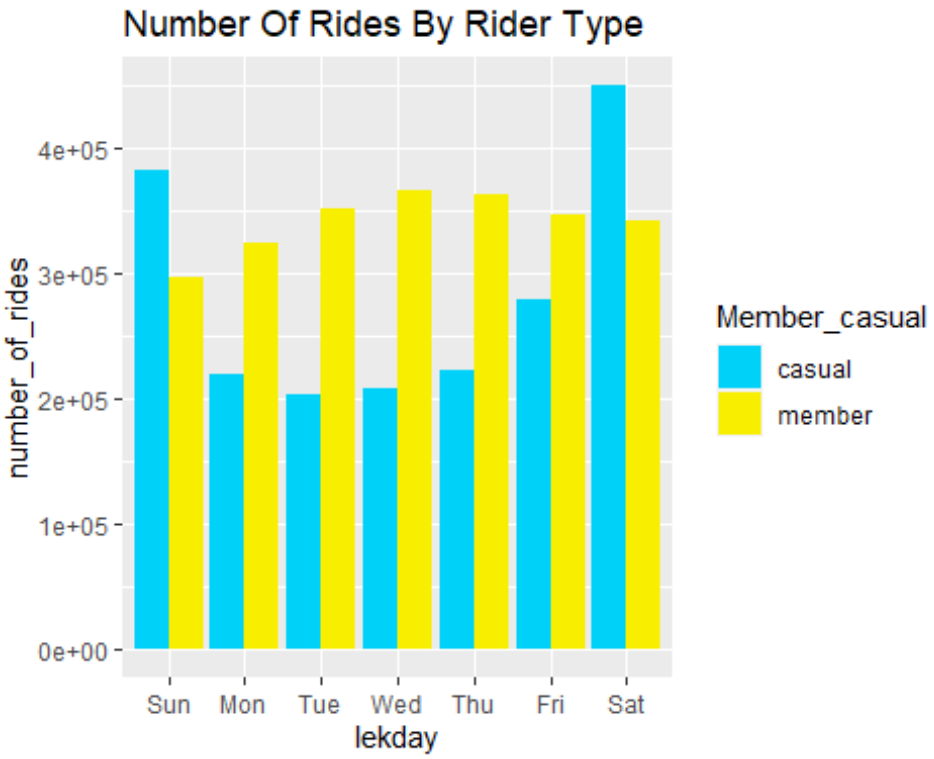
Here I learn how data analysts interpret results and share them with others to help stakeholders make effective data-driven decisions. In the share phase, visualization is a data analyst's best friend.

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.
```

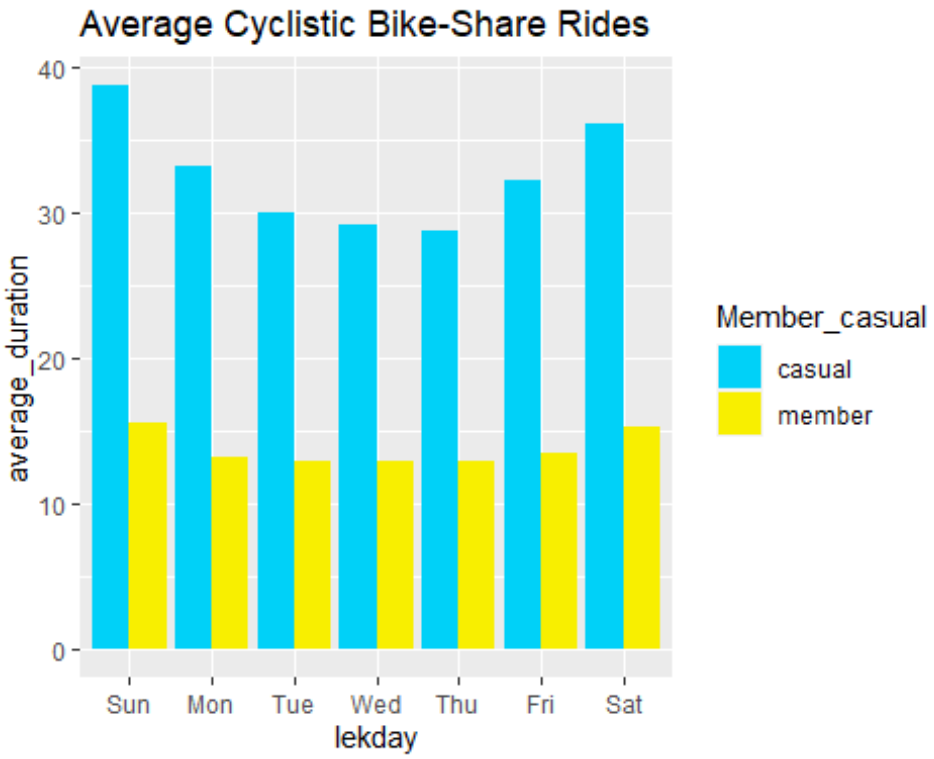


Visualization 2: Average Cyclistic Bike-Share Rides

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.