Cyclistic Ride Share

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RIDE SHARE CASE STUDY: A PROJECT OF THE GOOGLE DATA ANALYTICS PROFESSIONAL CERTIFICATE

The goal of this project is to conduct analysis to help answer the key question: “In what ways do members and casual riders use Divvy bikes differently?” For comprehensive information about the project, Kindly check the README file in this repository.

SETTING UP THE ENVIRONMENT

We shall begin by loading the required packages onto the environment before importing the datasets.

```r
library(tidyverse)  #for data import and wrangling
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.3.6      v purrr   0.3.4
## v tibble  3.1.8      v dplyr   1.0.10
## v tidyr   1.2.1      v stringr 1.4.1
## v readr   2.1.2      v forcats 0.5.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

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

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

```r
library(ggplot2)  #for data visualization
```

IMPORT DATA

We then upload the Divvy datasets (csv files) here.

```
q2_2019 <- read_csv("Divvy_Trips_2019_Q2.csv")
```

```
## Rows: 1108163 Columns: 12
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (4): 03 - Rental Start Station Name, 02 - Rental End Station Name, User...
## dbl  (5): 01 - Rental Details Rental ID, 01 - Rental Details Bike ID, 03 - R...
## dttm (2): 01 - Rental Details Local Start Time, 01 - Rental Details Local En...
##
## 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.
```

```
q3_2019 <- read_csv("Divvy_Trips_2019_Q3.csv")
```

```
## Rows: 1640718 Columns: 12
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (4): from_station_name, to_station_name, usertype, gender
## dbl  (5): trip_id, bikeid, from_station_id, to_station_id, birthyear
## dttm (2): start_time, end_time
##
## 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.
```

```
q4_2019 <- read_csv("Divvy_Trips_2019_Q4.csv")
```

```
## Rows: 704054 Columns: 12
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr  (4): from_station_name, to_station_name, usertype, gender
## dbl  (5): trip_id, bikeid, from_station_id, to_station_id, birthyear
## dttm (2): start_time, end_time
##
## 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.
```

```
q1_2020 <- read_csv("Divvy_Trips_2020_Q1.csv")
```

```
## Rows: 426887 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.
```

WRANGLE DATA AND COMBINE INTO A SINGLE FILE

We first Compare column names in each of the files. While the names don't have to be in the same order, they DO need to match perfectly before we can use a command to join them into one file.

```
colnames(q3_2019)
```

```
##  [1] "trip_id"           "start_time"        "end_time"
##  [4] "bikeid"            "tripduration"      "from_station_id"
##  [7] "from_station_name" "to_station_id"     "to_station_name"
## [10] "usertype"          "gender"            "birthyear"
```

```
colnames(q4_2019)
```

```
##  [1] "trip_id"           "start_time"        "end_time"
##  [4] "bikeid"            "tripduration"      "from_station_id"
##  [7] "from_station_name" "to_station_id"     "to_station_name"
## [10] "usertype"          "gender"            "birthyear"
```

```
colnames(q2_2019)
```

```
##  [1] "01 - Rental Details Rental ID"
##  [2] "01 - Rental Details Local Start Time"
##  [3] "01 - Rental Details Local End Time"
##  [4] "01 - Rental Details Bike ID"
##  [5] "01 - Rental Details Duration In Seconds Uncapped"
##  [6] "03 - Rental Start Station ID"
##  [7] "03 - Rental Start Station Name"
##  [8] "02 - Rental End Station ID"
##  [9] "02 - Rental End Station Name"
## [10] "User Type"
## [11] "Member Gender"
## [12] "05 - Member Details Member Birthday Year"
```

```
colnames(q1_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"
```

```
(q4_2019 <- rename(q4_2019
                   ,ride_id = trip_id
                   ,rideable_type = bikeid
                   ,started_at = start_time
                   ,ended_at = end_time
                   ,start_station_name = from_station_name
                   ,start_station_id = from_station_id
                   ,end_station_name = to_station_name
                   ,end_station_id = to_station_id
                   ,member_casual = usertype))
```

Renaming columns to make them consistent with q1_2020 (as this will be the supposed going-forward table design for Divvy)

```
## # A tibble: 704,054 x 12
##     ride_id started_at          ended_at            rideable_t~1 tripd~2 start~3
##       <dbl> <dttm>              <dttm>                     <dbl>   <dbl>   <dbl>
##  1 25223640 2019-10-01 00:01:39 2019-10-01 00:17:20         2215     940      20
##  2 25223641 2019-10-01 00:02:16 2019-10-01 00:06:34         6328     258      19
##  3 25223642 2019-10-01 00:04:32 2019-10-01 00:18:43         3003     850      84
##  4 25223643 2019-10-01 00:04:32 2019-10-01 00:43:43         3275    2350     313
##  5 25223644 2019-10-01 00:04:34 2019-10-01 00:35:42         5294    1867     210
##  6 25223645 2019-10-01 00:04:38 2019-10-01 00:10:51         1891     373     156
##  7 25223646 2019-10-01 00:04:52 2019-10-01 00:22:45         1061    1072      84
##  8 25223647 2019-10-01 00:04:57 2019-10-01 00:29:16         1274    1458     156
##  9 25223648 2019-10-01 00:05:20 2019-10-01 00:29:18         6011    1437     156
## 10 25223649 2019-10-01 00:05:20 2019-10-01 02:23:46         2957    8306     336
## # ... with 704,044 more rows, 6 more variables: start_station_name <chr>,
## #   end_station_id <dbl>, end_station_name <chr>, member_casual <chr>,
## #   gender <chr>, birthyear <dbl>, and abbreviated variable names
## #   1: rideable_type, 2: tripduration, 3: start_station_id
```

```
(q3_2019 <- rename(q3_2019
                   ,ride_id = trip_id
                   ,rideable_type = bikeid
                   ,started_at = start_time
                   ,ended_at = end_time
                   ,start_station_name = from_station_name
                   ,start_station_id = from_station_id
                   ,end_station_name = to_station_name
                   ,end_station_id = to_station_id
                   ,member_casual = usertype))
```

```
## # A tibble: 1,640,718 x 12
##     ride_id started_at          ended_at            rideable_t~1 tripd~2 start~3
##       <dbl> <dttm>              <dttm>                     <dbl>   <dbl>   <dbl>
##  1 23479388 2019-07-01 00:00:27 2019-07-01 00:20:41         3591    1214     117
##  2 23479389 2019-07-01 00:01:16 2019-07-01 00:18:44         5353    1048     381
##  3 23479390 2019-07-01 00:01:48 2019-07-01 00:27:42         6180    1554     313
##  4 23479391 2019-07-01 00:02:07 2019-07-01 00:27:10         5540    1503     313
##  5 23479392 2019-07-01 00:02:13 2019-07-01 00:22:26         6014    1213     168
##  6 23479393 2019-07-01 00:02:21 2019-07-01 00:07:31         4941     310     300
##  7 23479394 2019-07-01 00:02:24 2019-07-01 00:23:12         3770    1248     168
##  8 23479395 2019-07-01 00:02:26 2019-07-01 00:28:16         5442    1550     313
##  9 23479396 2019-07-01 00:02:34 2019-07-01 00:28:57         2957    1583      43
## 10 23479397 2019-07-01 00:02:45 2019-07-01 00:29:14         6091    1589      43
## # ... with 1,640,708 more rows, 6 more variables: start_station_name <chr>,
## #   end_station_id <dbl>, end_station_name <chr>, member_casual <chr>,
## #   gender <chr>, birthyear <dbl>, and abbreviated variable names
## #   1: rideable_type, 2: tripduration, 3: start_station_id
```

```
(q2_2019 <- rename(q2_2019
                   ,ride_id = "01 - Rental Details Rental ID"
                   ,rideable_type = "01 - Rental Details Bike ID"
                   ,started_at = "01 - Rental Details Local Start Time"
                   ,ended_at = "01 - Rental Details Local End Time"
                   ,start_station_name = "03 - Rental Start Station Name"
                   ,start_station_id = "03 - Rental Start Station ID"
                   ,end_station_name = "02 - Rental End Station Name"
                   ,end_station_id = "02 - Rental End Station ID"
                   ,member_casual = "User Type"))
```

```
## # A tibble: 1,108,163 x 12
##     ride_id started_at          ended_at            rideable_t~1 01 - ~2 start~3
##       <dbl> <dttm>              <dttm>                     <dbl>   <dbl>   <dbl>
##  1 22178529 2019-04-01 00:02:22 2019-04-01 00:09:48         6251     446      81
##  2 22178530 2019-04-01 00:03:02 2019-04-01 00:20:30         6226    1048     317
##  3 22178531 2019-04-01 00:11:07 2019-04-01 00:15:19         5649     252     283
##  4 22178532 2019-04-01 00:13:01 2019-04-01 00:18:58         4151     357      26
##  5 22178533 2019-04-01 00:19:26 2019-04-01 00:36:13         3270    1007     202
##  6 22178534 2019-04-01 00:19:39 2019-04-01 00:23:56         3123     257     420
##  7 22178535 2019-04-01 00:26:33 2019-04-01 00:35:41         6418     548     503
##  8 22178536 2019-04-01 00:29:48 2019-04-01 00:36:11         4513     383     260
##  9 22178537 2019-04-01 00:32:07 2019-04-01 01:07:44         3280    2137     211
## 10 22178538 2019-04-01 00:32:19 2019-04-01 01:07:39         5534    2120     211
## # ... with 1,108,153 more rows, 6 more variables: start_station_name <chr>,
## #   end_station_id <dbl>, end_station_name <chr>, member_casual <chr>,
## #   ‘Member Gender‘ <chr>, ‘05 - Member Details Member Birthday Year‘ <dbl>,
## #   and abbreviated variable names 1: rideable_type,
## #   2: ‘01 - Rental Details Duration In Seconds Uncapped‘, 3: start_station_id
```

```
str(q1_2020)
```

Inspecting the dataframes to look for incongruencies

```
## spec_tbl_df [426,887 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:426887] "EACB19130B0CDA4A" "8FED874C809DC021" "789F3C21E472CA96" "C9A3
##  $ rideable_type     : chr [1:426887] "docked_bike" "docked_bike" "docked_bike" "docked_bike" ...
##  $ started_at        : POSIXct[1:426887], format: "2020-01-21 20:06:59" "2020-01-30 14:22:39" ...
##  $ ended_at          : POSIXct[1:426887], format: "2020-01-21 20:14:30" "2020-01-30 14:26:22" ...
##  $ start_station_name: chr [1:426887] "Western Ave & Leland Ave" "Clark St & Montrose Ave" "Broadway
##  $ start_station_id  : num [1:426887] 239 234 296 51 66 212 96 96 212 38 ...
##  $ end_station_name  : chr [1:426887] "Clark St & Leland Ave" "Southport Ave & Irving Park Rd" "Wilto
##  $ end_station_id    : num [1:426887] 326 318 117 24 212 96 212 212 96 100 ...
##  $ start_lat         : num [1:426887] 42 42 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:426887] -87.7 -87.7 -87.6 -87.6 -87.6 ...
##  $ end_lat           : num [1:426887] 42 42 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:426887] -87.7 -87.7 -87.7 -87.6 -87.6 ...
##  $ member_casual     : chr [1:426887] "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_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(q4_2019)
```

```
## spec_tbl_df [704,054 x 12] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : num [1:704054] 25223640 25223641 25223642 25223643 25223644 ...
##  $ started_at        : POSIXct[1:704054], format: "2019-10-01 00:01:39" "2019-10-01 00:02:16" ...
##  $ ended_at          : POSIXct[1:704054], format: "2019-10-01 00:17:20" "2019-10-01 00:06:34" ...
##  $ rideable_type     : num [1:704054] 2215 6328 3003 3275 5294 ...
##  $ tripduration      : num [1:704054] 940 258 850 2350 1867 ...
##  $ start_station_id  : num [1:704054] 20 19 84 313 210 156 84 156 156 336 ...
##  $ start_station_name: chr [1:704054] "Sheffield Ave & Kingsbury St" "Throop (Loomis) St & Taylor St
##  $ end_station_id    : num [1:704054] 309 241 199 290 382 226 142 463 463 336 ...
##  $ end_station_name  : chr [1:704054] "Leavitt St & Armitage Ave" "Morgan St & Polk St" "Wabash Ave &
##  $ member_casual     : chr [1:704054] "Subscriber" "Subscriber" "Subscriber" "Subscriber" ...
##  $ gender            : chr [1:704054] "Male" "Male" "Female" "Male" ...
##  $ birthyear         : num [1:704054] 1987 1998 1991 1990 1987 ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   trip_id = col_double(),
##   ..   start_time = col_datetime(format = ""),
##   ..   end_time = col_datetime(format = ""),
##   ..   bikeid = col_double(),
##   ..   tripduration = col_number(),
##   ..   from_station_id = col_double(),
##   ..   from_station_name = col_character(),
##   ..   to_station_id = col_double(),
##   ..   to_station_name = col_character(),
##   ..   usertype = col_character(),
##   ..   gender = col_character(),
##   ..   birthyear = col_double()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(q3_2019)
```

```
## spec_tbl_df [1,640,718 x 12] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : num [1:1640718] 23479388 23479389 23479390 23479391 23479392 ...
##  $ started_at        : POSIXct[1:1640718], format: "2019-07-01 00:00:27" "2019-07-01 00:01:16" ...
##  $ ended_at          : POSIXct[1:1640718], format: "2019-07-01 00:20:41" "2019-07-01 00:18:44" ...
##  $ rideable_type     : num [1:1640718] 3591 5353 6180 5540 6014 ...
##  $ tripduration      : num [1:1640718] 1214 1048 1554 1503 1213 ...
##  $ start_station_id  : num [1:1640718] 117 381 313 313 168 300 168 313 43 43 ...
##  $ start_station_name: chr [1:1640718] "Wilton Ave & Belmont Ave" "Western Ave & Monroe St" "Lakeview
##  $ end_station_id    : num [1:1640718] 497 203 144 144 62 232 62 144 195 195 ...
##  $ end_station_name  : chr [1:1640718] "Kimball Ave & Belmont Ave" "Western Ave & 21st St" "Larrabee
##  $ member_casual     : chr [1:1640718] "Subscriber" "Customer" "Customer" "Customer" ...
##  $ gender            : chr [1:1640718] "Male" NA NA NA ...
##  $ birthyear         : num [1:1640718] 1992 NA NA NA NA ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   trip_id = col_double(),
##   ..   start_time = col_datetime(format = ""),
##   ..   end_time = col_datetime(format = ""),
##   ..   bikeid = col_double(),
##   ..   tripduration = col_number(),
##   ..   from_station_id = col_double(),
##   ..   from_station_name = col_character(),
##   ..   to_station_id = col_double(),
##   ..   to_station_name = col_character(),
##   ..   usertype = col_character(),
##   ..   gender = col_character(),
##   ..   birthyear = col_double()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
str(q2_2019)
```

```
## spec_tbl_df [1,108,163 x 12] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id                                       : num [1:1108163] 22178529 22178530 22178531 22178
##  $ started_at                                    : POSIXct[1:1108163], format: "2019-04-01 00:02:22
##  $ ended_at                                      : POSIXct[1:1108163], format: "2019-04-01 00:09:48
##  $ rideable_type                                 : num [1:1108163] 6251 6226 5649 4151 3270 ...
##  $ 01 - Rental Details Duration In Seconds Uncapped: num [1:1108163] 446 1048 252 357 1007 ...
##  $ start_station_id                              : num [1:1108163] 81 317 283 26 202 420 503 260 2
##  $ start_station_name                            : chr [1:1108163] "Daley Center Plaza" "Wood St &
##  $ end_station_id                                : num [1:1108163] 56 59 174 133 129 426 500 499 2
##  $ end_station_name                              : chr [1:1108163] "Desplaines St & Kinzie St" "Wal
##  $ member_casual                                 : chr [1:1108163] "Subscriber" "Subscriber" "Subsc
##  $ Member Gender                                 : chr [1:1108163] "Male" "Female" "Male" "Male" .
##  $ 05 - Member Details Member Birthday Year      : num [1:1108163] 1975 1984 1990 1993 1992 ...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ‘01 - Rental Details Rental ID‘ = col_double(),
##   ..   ‘01 - Rental Details Local Start Time‘ = col_datetime(format = ""),
##   ..   ‘01 - Rental Details Local End Time‘ = col_datetime(format = ""),
##   ..   ‘01 - Rental Details Bike ID‘ = col_double(),
##   ..   ‘01 - Rental Details Duration In Seconds Uncapped‘ = col_number(),
##   ..   ‘03 - Rental Start Station ID‘ = col_double(),
##   ..   ‘03 - Rental Start Station Name‘ = col_character(),
##   ..   ‘02 - Rental End Station ID‘ = col_double(),
##   ..   ‘02 - Rental End Station Name‘ = col_character(),
##   ..   ‘User Type‘ = col_character(),
##   ..   ‘Member Gender‘ = col_character(),
##   ..   ‘05 - Member Details Member Birthday Year‘ = col_double()
##   .. )
##  - attr(*, "problems")=<externalptr>
```

```
q4_2019 <-  mutate(q4_2019, ride_id = as.character(ride_id)
                   ,rideable_type = as.character(rideable_type))
q3_2019 <-  mutate(q3_2019, ride_id = as.character(ride_id)
                   ,rideable_type = as.character(rideable_type))
q2_2019 <-  mutate(q2_2019, ride_id = as.character(ride_id)
                   ,rideable_type = as.character(rideable_type))
```

Converting ride_id and rideable_type to character so that they can stack correctly

```
all_trips <- bind_rows(q2_2019, q3_2019, q4_2019, q1_2020)
```

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

```
all_trips <- all_trips %>%
  select(-c(start_lat, start_lng, end_lat, end_lng, birthyear, gender, "01 - Rental Details Duration In
```

Removing lat, long, birthyear, and gender fields as this data was dropped starting from 2020

CLEAN UP AND ADD DATA FOR ANALYSIS

Let's begin by inspecting the table that has been created

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

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

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

```
## [1] 3879822
```

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

```
## [1] 3879822       9
```

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

```
## # A tibble: 6 x 9
##   ride_id  started_at          ended_at            rideable_type start~1 start~2
##   <chr>    <dttm>              <dttm>              <chr>           <dbl> <chr>
## 1 22178529 2019-04-01 00:02:22 2019-04-01 00:09:48 6251               81 Daley ~
## 2 22178530 2019-04-01 00:03:02 2019-04-01 00:20:30 6226              317 Wood S~
## 3 22178531 2019-04-01 00:11:07 2019-04-01 00:15:19 5649              283 LaSall~
## 4 22178532 2019-04-01 00:13:01 2019-04-01 00:18:58 4151               26 McClur~
## 5 22178533 2019-04-01 00:19:26 2019-04-01 00:36:13 3270              202 Halste~
## 6 22178534 2019-04-01 00:19:39 2019-04-01 00:23:56 3123              420 Ellis ~
## # ... with 3 more variables: end_station_id <dbl>, end_station_name <chr>,
## #   member_casual <chr>, and abbreviated variable names 1: start_station_id,
## #   2: start_station_name
```

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

```
## tibble [3,879,822 x 9] (S3: tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:3879822] "22178529" "22178530" "22178531" "22178532" ...
##  $ started_at        : POSIXct[1:3879822], format: "2019-04-01 00:02:22" "2019-04-01 00:03:02" ...
##  $ ended_at          : POSIXct[1:3879822], format: "2019-04-01 00:09:48" "2019-04-01 00:20:30" ...
##  $ rideable_type     : chr [1:3879822] "6251" "6226" "5649" "4151" ...
##  $ start_station_id  : num [1:3879822] 81 317 283 26 202 420 503 260 211 211 ...
##  $ start_station_name: chr [1:3879822] "Daley Center Plaza" "Wood St & Taylor St" "LaSalle St & Jacks
##  $ end_station_id    : num [1:3879822] 56 59 174 133 129 426 500 499 211 211 ...
##  $ end_station_name  : chr [1:3879822] "Desplaines St & Kinzie St" "Wabash Ave & Roosevelt Rd" "Canal
##  $ member_casual     : chr [1:3879822] "Subscriber" "Subscriber" "Subscriber" "Subscriber" ...
```

```
summary(all_trips)  #Statistical summary of data; mainly for numeric data
```

```
##    ride_id            started_at
##  Length:3879822     Min.   :2019-04-01 00:02:22.00
##  Class :character   1st Qu.:2019-06-23 07:49:09.25
##  Mode  :character   Median :2019-08-14 17:43:38.00
##                     Mean   :2019-08-26 00:49:59.38
##                     3rd Qu.:2019-10-12 12:10:21.00
##                     Max.   :2020-03-31 23:51:34.00
##
##     ended_at                      rideable_type      start_station_id
##  Min.   :2019-04-01 00:09:48.00   Length:3879822     Min.   :  1.0
##  1st Qu.:2019-06-23 08:20:27.75   Class :character   1st Qu.: 77.0
##  Median :2019-08-14 18:02:04.00   Mode  :character   Median :174.0
##  Mean   :2019-08-26 01:14:37.06                      Mean   :202.9
##  3rd Qu.:2019-10-12 12:36:16.75                      3rd Qu.:291.0
##  Max.   :2020-05-19 20:10:34.00                      Max.   :675.0
##
##  start_station_name end_station_id  end_station_name   member_casual
##  Length:3879822     Min.   :  1.0   Length:3879822     Length:3879822
##  Class :character   1st Qu.: 77.0   Class :character   Class :character
##  Mode  :character   Median :174.0   Mode  :character   Mode  :character
##                     Mean   :203.8
##                     3rd Qu.:291.0
##                     Max.   :675.0
##                     NA's   :1
```

Now, we have discovered a few problems that we need to fix such as:

- In the "member_casual" column, there are two names for members ("member" and "Subscriber") and two names for casual riders ("Customer" and "casual"). We will need to consolidate that from four to two labels.
- The data can only be aggregated at the ride-level, which is too granular. We will want to add some additional columns of data – such as day, month, year – that will provide additional opportunities to aggregate the data.
- We will want to add a calculated field for length of ride since the 2020_Q1 data did not have the "trip_duration" column. We will add "ride_length" to the entire dataframe for consistency.
- There are some rides where trip_duration shows up as negative, including several hundred rides where Divvy took bikes out of circulation for Quality Control reasons. We will want to delete these rides.

Way forward:

- In the "member_casual" column, we'll replace "Subscriber" with "member" and "Customer" with "casual".
- Before 2020, Divvy used different labels for these two types of riders … we will want to make our dataframe consistent with their current nomenclature
- N.B.: "Level" is a special property of a column that is retained even if a subset does not contain any values from a specific level

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

Begin by seeing how many observations fall under each usertype

```
##
##     casual   Customer     member Subscriber
##      48480     857474     378407    2595461
```

```r
all_trips <-  all_trips %>%
  mutate(member_casual = recode(member_casual
                           ,"Subscriber" = "member"
                           ,"Customer" = "casual"))
```

Reassign to the desired values (we will go with the current 2020 labels)

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

Checking to make sure the proper number of observations were reassigned

```
##
##  casual  member
##  905954 2973868
```

Then 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 we could only aggregate at the ride level

```
all_trips$date <- as.Date(all_trips$started_at) #The default format is yyyy-mm-dd
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$day_of_week <- format(as.Date(all_trips$date), "%A")
```

Then we add a "ride_length" calculation to all_trips (in seconds)

```
all_trips$ride_length <- difftime(all_trips$ended_at,all_trips$started_at)
```

```
str(all_trips)
```

Inspecting the structure of the columns

```
## tibble [3,879,822 x 15] (S3: tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:3879822] "22178529" "22178530" "22178531" "22178532" ...
##  $ started_at        : POSIXct[1:3879822], format: "2019-04-01 00:02:22" "2019-04-01 00:03:02" ...
##  $ ended_at          : POSIXct[1:3879822], format: "2019-04-01 00:09:48" "2019-04-01 00:20:30" ...
##  $ rideable_type     : chr [1:3879822] "6251" "6226" "5649" "4151" ...
##  $ start_station_id  : num [1:3879822] 81 317 283 26 202 420 503 260 211 211 ...
##  $ start_station_name: chr [1:3879822] "Daley Center Plaza" "Wood St & Taylor St" "LaSalle St & Jacks
##  $ end_station_id    : num [1:3879822] 56 59 174 133 129 426 500 499 211 211 ...
##  $ end_station_name  : chr [1:3879822] "Desplaines St & Kinzie St" "Wabash Ave & Roosevelt Rd" "Canal
##  $ member_casual     : chr [1:3879822] "member" "member" "member" "member" ...
##  $ date              : Date[1:3879822], format: "2019-04-01" "2019-04-01" ...
##  $ month             : chr [1:3879822] "04" "04" "04" "04" ...
##  $ day               : chr [1:3879822] "01" "01" "01" "01" ...
##  $ year              : chr [1:3879822] "2019" "2019" "2019" "2019" ...
##  $ day_of_week       : chr [1:3879822] "Monday" "Monday" "Monday" "Monday" ...
##  $ ride_length       : 'difftime' num [1:3879822] 446 1048 252 357 ...
##   ..- attr(*, "units")= chr "secs"
```

```
is.factor(all_trips$ride_length)
```

Converting "ride_length" from Factor to numeric so we can run calculations on the data

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

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

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

Removing "bad" data The dataframe includes a few hundred entries when bikes were taken out of docks and checked for quality by Divvy or ride_length was negative. We 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),]
```

CONDUCT DESCRIPTIVE ANALYSIS

Descriptive analysis on ride_length (all figures in seconds). Using the summary(), we can get the mean/straight average (which is; total ride length / rides), median (midpoint number in the ascending array of ride lengths), max (longest ride), min (shortest ride).

```
summary(all_trips_v2$ride_length)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##       1     412     712    1479    1289 9387024
```

```
aggregate(all_trips_v2$ride_length ~ all_trips_v2$member_casual, FUN = mean)
```

Comparing members and casual users

```
##   all_trips_v2$member_casual all_trips_v2$ride_length
## 1                     casual                3552.7502
## 2                     member                 850.0662
```

```
aggregate(all_trips_v2$ride_length ~ all_trips_v2$member_casual, FUN = median)
```

```
##   all_trips_v2$member_casual all_trips_v2$ride_length
## 1                     casual                     1546
## 2                     member                      589
```

```
aggregate(all_trips_v2$ride_length ~ all_trips_v2$member_casual, FUN = max)
```

```
##   all_trips_v2$member_casual all_trips_v2$ride_length
## 1                     casual                  9387024
## 2                     member                  9056634
```

```
aggregate(all_trips_v2$ride_length ~ all_trips_v2$member_casual, FUN = min)
```

```
##   all_trips_v2$member_casual all_trips_v2$ride_length
## 1                     casual                        2
## 2                     member                        1
```

```
aggregate(all_trips_v2$ride_length ~ all_trips_v2$member_casual + all_trips_v2$day_of_week, FUN = mean)
```

Viewing the average ride time by each day for members vs casual users

```
##    all_trips_v2$member_casual all_trips_v2$day_of_week all_trips_v2$ride_length
## 1                      casual                   Friday                3773.8351
## 2                      member                   Friday                 824.5305
## 3                      casual                   Monday                3372.2869
## 4                      member                   Monday                 842.5726
## 5                      casual                 Saturday                3331.9138
## 6                      member                 Saturday                 968.9337
## 7                      casual                   Sunday                3581.4054
## 8                      member                   Sunday                 919.9746
## 9                      casual                 Thursday                3682.9847
## 10                     member                 Thursday                 823.9278
## 11                     casual                  Tuesday                3596.3599
## 12                     member                  Tuesday                 826.1427
## 13                     casual                Wednesday                3718.6619
## 14                     member                Wednesday                 823.9996
```

```
all_trips_v2$day_of_week <- ordered(all_trips_v2$day_of_week, levels=c("Sunday", "Monday", "Tuesday", "W
```

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

```
aggregate(all_trips_v2$ride_length ~ all_trips_v2$member_casual + all_trips_v2$day_of_week, FUN = mean)
```

Running the average ride time by each day for members vs casual users again:

```
##    all_trips_v2$member_casual all_trips_v2$day_of_week all_trips_v2$ride_length
## 1                      casual                   Sunday                3581.4054
## 2                      member                   Sunday                 919.9746
## 3                      casual                   Monday                3372.2869
## 4                      member                   Monday                 842.5726
## 5                      casual                  Tuesday                3596.3599
## 6                      member                  Tuesday                 826.1427
## 7                      casual                Wednesday                3718.6619
## 8                      member                Wednesday                 823.9996
## 9                      casual                 Thursday                3682.9847
## 10                     member                 Thursday                 823.9278
## 11                     casual                   Friday                3773.8351
## 12                     member                   Friday                 824.5305
## 13                     casual                 Saturday                3331.9138
## 14                     member                 Saturday                 968.9337
```

```
all_trips_v2 %>%
  mutate(weekday = wday(started_at, label = TRUE)) %>%  #creates weekday field using wday()
  group_by(member_casual, weekday) %>%  #groups by usertype and weekday
  summarise(number_of_rides = n()                           #calculates the number of rides and average
  ,average_duration = mean(ride_length)) %>%        # calculates the average duration
  arrange(member_casual, weekday)
```

analyzing ridership data by type and weekday

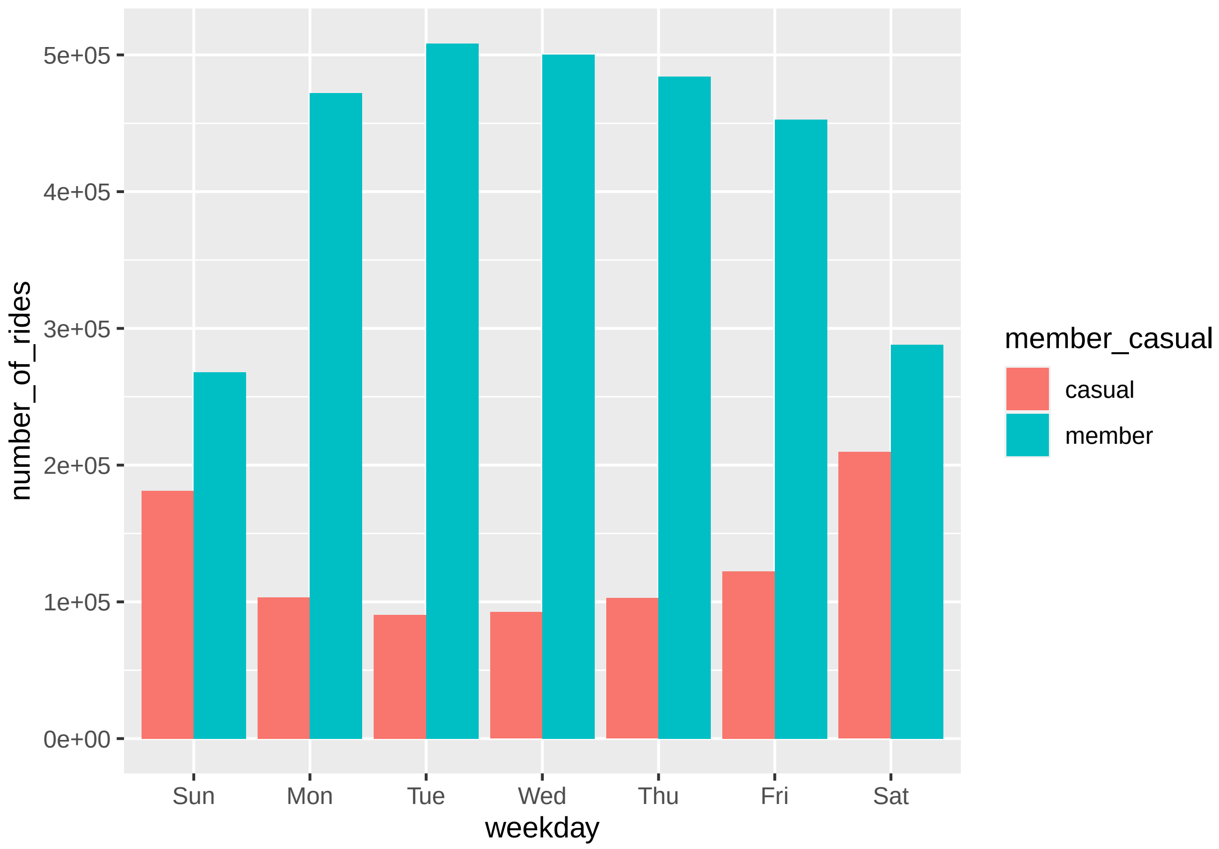
```
## `summarise()` has grouped output by 'member_casual'. You can override using the
## `.groups` argument.
```

```
## # A tibble: 14 x 4
## # Groups:   member_casual [2]
##    member_casual weekday number_of_rides average_duration
##    <chr>         <ord>             <int>            <dbl>
##  1 casual        Sun              181293            3581.
##  2 casual        Mon              103296            3372.
##  3 casual        Tue               90510            3596.
##  4 casual        Wed               92457            3719.
##  5 casual        Thu              102679            3683.
##  6 casual        Fri              122404            3774.
##  7 casual        Sat              209543            3332.
##  8 member        Sun              267965             920.
##  9 member        Mon              472196             843.
## 10 member        Tue              508445             826.
## 11 member        Wed              500329             824.
## 12 member        Thu              484177             824.
## 13 member        Fri              452790             825.
## 14 member        Sat              287958             969.
```

```
all_trips_v2 %>%
  mutate(weekday = wday(started_at, label = TRUE)) %>%
  group_by(member_casual, weekday) %>%
  summarise(number_of_rides = n()
            ,average_duration = mean(ride_length)) %>%
  arrange(member_casual, weekday)  %>%
  ggplot(aes(x = weekday, y = number_of_rides, fill = member_casual)) +
  geom_col(position = "dodge")
```

visualizing the number of rides by rider type

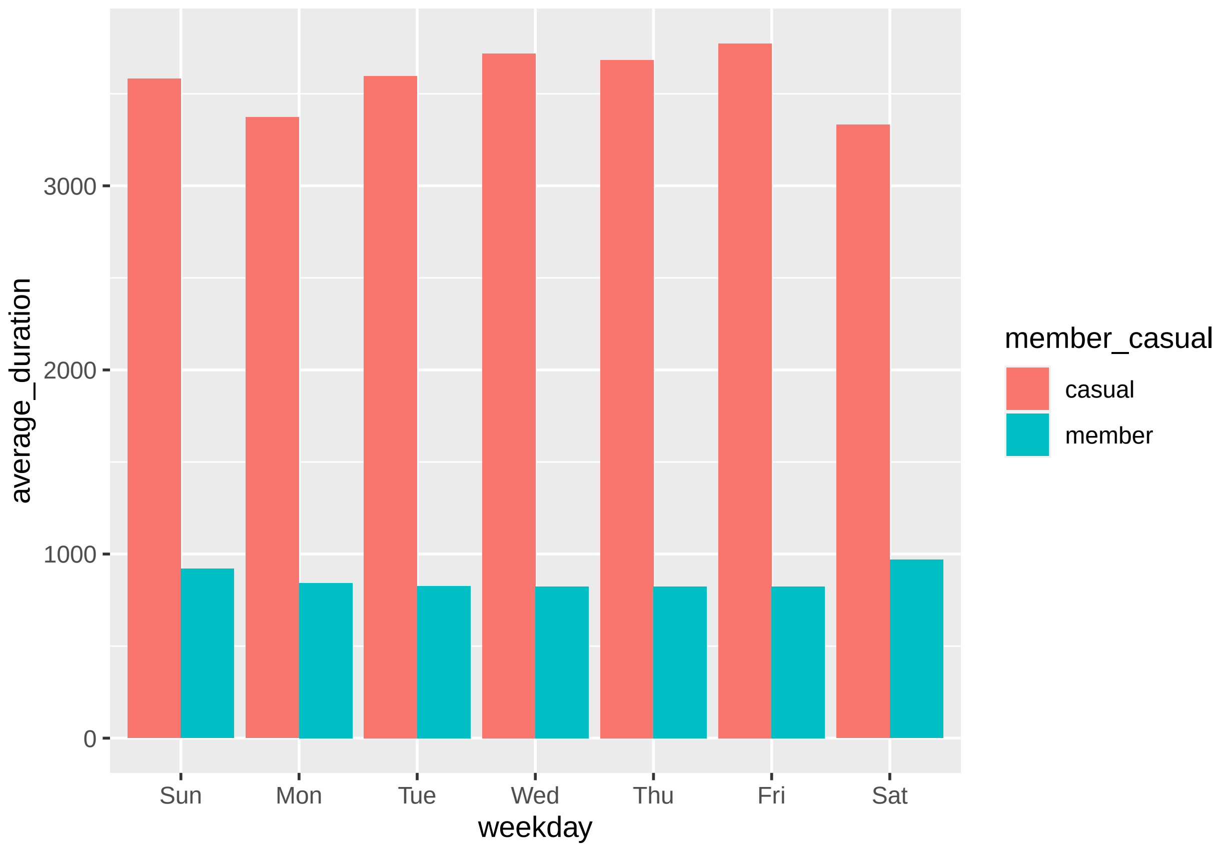
```
## `summarise()` has grouped output by 'member_casual'. You can override using the
## `.groups` argument.
```



```
all_trips_v2 %>%
  mutate(weekday = wday(started_at, label = TRUE)) %>%
  group_by(member_casual, weekday) %>%
  summarise(number_of_rides = n()
            ,average_duration = mean(ride_length)) %>%
  arrange(member_casual, weekday)  %>%
  ggplot(aes(x = weekday, y = average_duration, fill = member_casual)) +
  geom_col(position = "dodge")
```

Creating visualization for average duration

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


3000
2000
1000
0
average_duration
Sun
Mon
Tue
Wed
Thu
Fri
Sat
weekday
member_casual
casual
member