Divvy Exercise Full Year Analysis

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This analysis is based on the Divvy case study “‘Sophisticated, Clear, and Polished’:

#Divvy and Data Visualization” written by Kevin Hartman #(found here: https://artscience.blog/home/divvy-dataviz-case-study (https://artscience.blog/home/divvy-dataviz-case-study)). #The purpose of this script is to consolidate downloaded Divvy data into a #single dataframe and then conduct simple analysis to help answer the key question: #“In what ways do members and casual riders use Divvy bikes differently?”

#

Install required packages

tidyverse for data import and wrangling

lubridate for date functions

ggplot for visualization

#

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

```
## ── Attaching packages ─────────────────────────────────────── tidyverse 1.3.2 ──
## ✔ ggplot2 3.3.6     ✔ purrr   0.3.4
## ✔ tibble  3.1.8     ✔ dplyr   1.0.9
## ✔ tidyr   1.2.0     ✔ stringr 1.4.1
## ✔ readr   2.1.2     ✔ forcats 0.5.2
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag()    masks stats::lag()
```

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

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

```
library(ggplot2)  #helps visualize data
getwd() #displays your working directory
```

```
## [1] "C:/Users/tom/RealTime/capstone-cyclistic-data/working data"
```

```
#=====================
# STEP 1: COLLECT DATA
#=====================
# Upload 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.
```

#== # STEP 2: WRANGLE DATA AND COMBINE INTO A SINGLE FILE #== # Compare column names 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"
```

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

```
(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))
```

```
## # A tibble: 704,054 × 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
## #   ¹rideable_type, ²tripduration, ³start_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 × 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
## #   ¹rideable_type, ²tripduration, ³start_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 × 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 ¹rideable_type,
## #   ²`01 - Rental Details Duration In Seconds Uncapped`, ³start_station_id
```

Inspect the dataframes and look for incongruencies

```
str(q1_2020)
```

```
## spec_tbl_df [426,887 × 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:426887] "EACB19130B0CDA4A" "8FED874C809DC021" "789F3C21E472CA96"
"C9A388DAC6ABF313" ...
##  $ 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" "Broa
dway & Belmont Ave" "Clark St & Randolph St" ...
##  $ 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"
"Wilton Ave & Belmont Ave" "Fairbanks Ct & Grand Ave" ...
##  $ 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 × 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 & Taylo
r St" "Milwaukee Ave & Grand Ave" "Lakeview Ave & Fullerton Pkwy" ...
##  $ 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 & Grand Ave" "Kedzie Ave & Palmer Ct" ...
##  $ 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 × 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" "Lak
eview Ave & Fullerton Pkwy" "Lakeview Ave & Fullerton Pkwy" ...
##  $ 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" "Larr
abee St & Webster Ave" "Larrabee St & Webster Ave" ...
##  $ 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 × 12] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id                                          : num [1:1108163] 22178529 22178530 22178531
22178532 22178533 ...
##  $ started_at                                       : POSIXct[1:1108163], format: "2019-04-01 00:
02:22" "2019-04-01 00:03:02" ...
##  $ ended_at                                         : POSIXct[1:1108163], format: "2019-04-01 00:
09:48" "2019-04-01 00:20:30" ...
##  $ 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 2
60 211 211 ...
##  $ start_station_name                               : chr [1:1108163] "Daley Center Plaza" "Wood
St & Taylor St" "LaSalle St & Jackson Blvd" "McClurg Ct & Illinois St" ...
##  $ end_station_id                                   : num [1:1108163] 56 59 174 133 129 426 500 4
99 211 211 ...
##  $ end_station_name                                 : chr [1:1108163] "Desplaines St & Kinzie St"
"Wabash Ave & Roosevelt Rd" "Canal St & Madison St" "Kingsbury St & Kinzie St" ...
##  $ member_casual                                    : chr [1:1108163] "Subscriber" "Subscriber"
"Subscriber" "Subscriber" ...
##  $ Member Gender                                    : chr [1:1108163] "Male" "Female" "Male" "Mal
e" ...
##  $ 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>
```

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

```
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))
```

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

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

Remove lat, long, birthyear, and gender fields as this data was dropped beginning in 2020

```
all_trips <- all_trips %>%
  select(-c(start_lat, start_lng, end_lat, end_lng, birthyear, gender, "01 - Rental Details Duration In Seconds Uncapped", "05 - Member Details Member Birthday Year", "Member Gender", "tripduration"))
```

#== ## STEP 3: CLEANUP AND ADD DATA TO PREPARE FOR ANALYSIS #==
## Inspect the new 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.  Also tail(all_trips)
```

```
## # A tibble: 6 × 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 ¹start_station_id,
## #   ²start_station_name
```

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

```
## tibble [3,879,822 × 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 &
Jackson Blvd" "McClurg Ct & Illinois St" ...
##  $ 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 St & Madison St" "Kingsbury St & Kinzie St" ...
##  $ member_casual     : chr [1:3879822] "Subscriber" "Subscriber" "Subscriber" "Subscriber" ...
```

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

```
##    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
```

There are a few problems we will need to fix:

(1) 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.

(2) 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 provide additional opportunities to aggregate the data.

(3) We will want to add a calculated field for length of ride since the 2020Q1 data did not have the “tripduration” column. We will add “ride_length” to the entire dataframe for consistency.

(4) There are some rides where tripduration 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.

In the “member_casual” column, 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

Begin by seeing how many observations fall under each usertype

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

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

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

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

Check to make sure the proper number of observations were reassigned

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

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

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

https://www.statmethods.net/input/dates.html (https://www.statmethods.net/input/dates.html) more on date formats in R found at that link

```
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")
```

Add a “ride_length” calculation to all_trips (in seconds)

https://stat.ethz.ch/R-manual/R-devel/library/base/html/difftime.html (https://stat.ethz.ch/R-manual/R-devel/library/base/html/difftime.html)

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

Inspect the structure of the columns

```
str(all_trips)
```

```
## tibble [3,879,822 × 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 &
Jackson Blvd" "McClurg Ct & Illinois St" ...
##  $ 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 St & Madison St" "Kingsbury St & Kinzie St" ...
##  $ 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"
```

Convert “ride_length” from Factor to numeric so we 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 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

https://www.datasciencemadesimple.com/delete-or-drop-rows-in-r-with-conditions-2/ (https://www.datasciencemadesimple.com/delete-or-drop-rows-in-r-with-conditions-2/)

```
all_trips_v2 <- all_trips[!(all_trips$start_station_name == "HQ QR" | all_trips$ride_length<0),]
```

#write final dataframe to a CSV.

```
write.csv(all_trips_v2, file = 'all_trips_v2.csv')
```

#===================================== # STEP 4: CONDUCT DESCRIPTIVE ANALYSIS #===================================== # Descriptive analysis on ride_length (all figures in seconds)

```
mean(all_trips_v2$ride_length) #straight average (total ride length / rides)
```

```
## [1] 1479.139
```

```
median(all_trips_v2$ride_length) #midpoint number in the ascending array of ride lengths
```

```
## [1] 712
```

```
max(all_trips_v2$ride_length) #longest ride
```

```
## [1] 9387024
```

```
min(all_trips_v2$ride_length) #shortest ride
```

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

You can condense the four lines above to one line using summary() on the specific attribute

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

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

Compare members and casual users

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

```
##   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
```

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

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

```
##    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
```

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

```
all_trips_v2$day_of_week <- ordered(all_trips_v2$day_of_week, levels=c("Sunday", "Monday", "Tuesda
y", "Wednesday", "Thursday", "Friday", "Saturday"))
```

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

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

analyze ridership data by type and weekday

```
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)
```

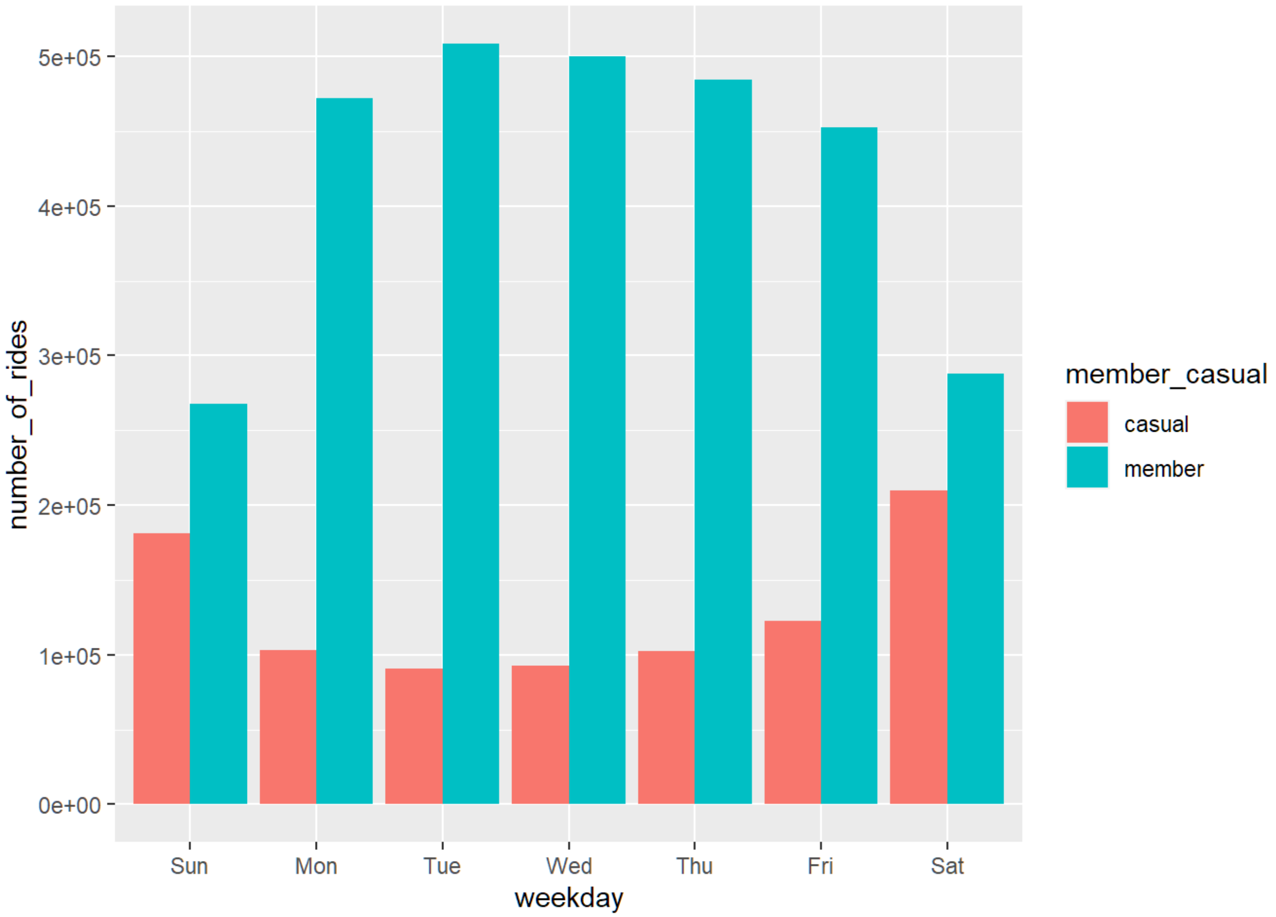
```
## `summarise()` has grouped output by 'member_casual'. You can override using the
## `.groups` argument.
```

```
## # A tibble: 14 × 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.
```

Let’s visualize the number of rides by rider type

```
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")
```

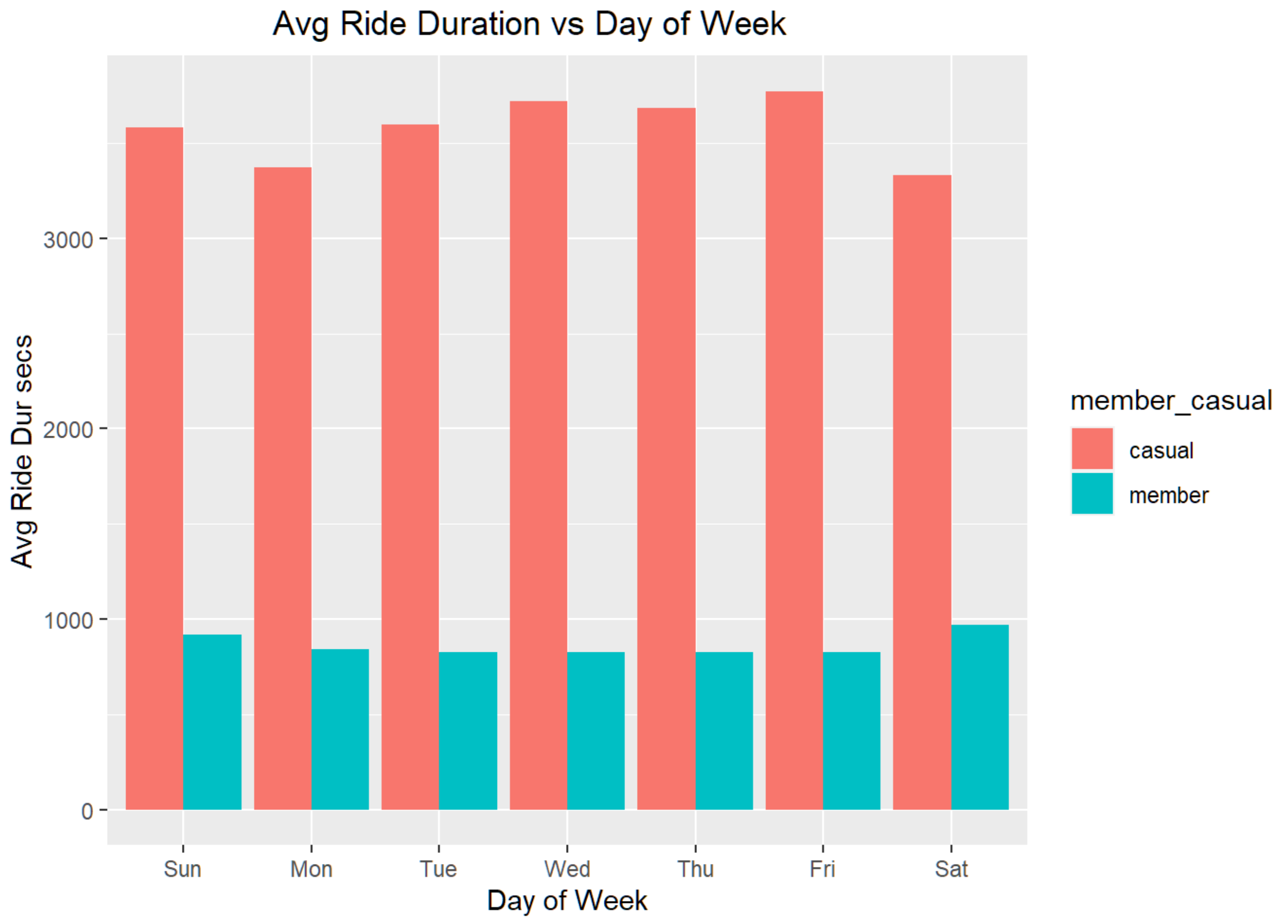
```
## `summarise()` has grouped output by 'member_casual'. You can override using the
## `.groups` argument.
```



Let’s create a visualization for average duration

```
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") + labs(title = '                Avg Ride Duration vs Day of Week',
y='Avg Ride Dur secs', x ='Day of Week', size = 5)
```

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



```
counts <- aggregate(all_trips_v2$ride_length ~ all_trips_v2$member_casual + all_trips_v2$day_of_week, FUN = mean)
write.csv(counts, file = 'avg_ride_length.csv')
```

```
  library(dplyr)
  write.csv(sample_frac(all_trips_v2,0.2), file = 'ran_sample_A_20_trips_v2.csv')
  write.csv(sample_frac(all_trips_v2,0.2), file = 'ran_sample_B_20_trips_v2.csv')
```

#Done!