# Google Data Analytics Cerficate Capstone Project

Daniel Geda

```
knitr::opts_chunk$set(echo = TRUE)
```

## Case Study 1: How Does a Bike-Share Navigate Speedy Success?

This porjects was done as part of my Google Data analytics cerficate capstone project.

Here's the scenario: We are working with a fictional company, Cyclistic, a bike-share company in Chicago. The director of marketing believes the company's future success depends on maximizing the number of annual memberships. Therefore, our team wants to understand how casual riders and annual members use Cyclistic bikes differently. From these insights, the marketing team will design a new marketing strategy to convert casual riders into annual members.

Specific Question: How do annual members and casual riders use Cyclistic bikes differently?

Data source: Cyclistic's historical trip data The data has been made available by Motivate International Inc. under this license (https://divvybikes.com/data-license-agreement).I am using the trip data from the 4 quarters in 2019.

### Load R libraries

```
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()
```

```
library(tidyr)
library(readr)
library(lubridate)
```

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

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

```
library(ggplot2)
```

### Load data into R

```
Q1_2019 <- read_csv("Divvy_Trips_2019_Q1.csv")
```

```
## Rows: 365069 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.
```

```
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.
```

**Look at the column names for the four quarters to make sure there are no dsicrepencies**

```
colnames(Q1_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(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"
```

**Rename Q2_2019 columns to make them consisent with the rest of the quarters**

```
Q2_2019 <- rename(Q2_2019
                  ,trip_id = "01 - Rental Details Rental ID"
                  ,start_time = "01 - Rental Details Local Start Time"
                  ,end_time = "01 - Rental Details Local End Time"
                  ,bikeid = "01 - Rental Details Bike ID"
                  ,tripduration = "01 - Rental Details Duration In Seconds Uncapped"
                  ,from_station_id = "03 - Rental Start Station ID"
                  ,from_station_name = "03 - Rental Start Station Name"
                  ,to_station_id = "02 - Rental End Station ID"
                  ,to_station_name = "02 - Rental End Station Name"
                  ,usertype = "User Type"
                  ,gender = "Member Gender"
                  ,birthyear = "05 - Member Details Member Birthday Year")
```

**Check if renaming was successful and do a double check using str() and colnames()**

```
str(Q1_2019)
```

```
## spec_tbl_df [365,069 x 12] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ trip_id          : num [1:365069] 21742443 21742444 21742445 21742446 21742447 ...
##  $ start_time       : POSIXct[1:365069], format: "2019-01-01 00:04:37" "2019-01-01 00:08:13" ...
##  $ end_time         : POSIXct[1:365069], format: "2019-01-01 00:11:07" "2019-01-01 00:15:34" ...
##  $ bikeid           : num [1:365069] 2167 4386 1524 252 1170 ...
##  $ tripduration     : num [1:365069] 390 441 829 1783 364 ...
##  $ from_station_id  : num [1:365069] 199 44 15 123 173 98 98 211 150 268 ...
##  $ from_station_name: chr [1:365069] "Wabash Ave & Grand Ave" "State St & Randolph St" "Racine Ave &
##  $ to_station_id    : num [1:365069] 84 624 644 176 35 49 49 142 148 141 ...
##  $ to_station_name  : chr [1:365069] "Milwaukee Ave & Grand Ave" "Dearborn St & Van Buren St (*)" "W
##  $ usertype         : chr [1:365069] "Subscriber" "Subscriber" "Subscriber" "Subscriber" ...
##  $ gender           : chr [1:365069] "Male" "Female" "Female" "Male" ...
##  $ birthyear        : num [1:365069] 1989 1990 1994 1993 1994 ...
##  - 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>
```

```r
str(Q2_2019)
```

```
## spec_tbl_df [1,108,163 x 12] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ trip_id          : num [1:1108163] 22178529 22178530 22178531 22178532 22178533 ...
##  $ start_time       : POSIXct[1:1108163], format: "2019-04-01 00:02:22" "2019-04-01 00:03:02" ...
##  $ end_time         : POSIXct[1:1108163], format: "2019-04-01 00:09:48" "2019-04-01 00:20:30" ...
##  $ bikeid           : num [1:1108163] 6251 6226 5649 4151 3270 ...
##  $ tripduration     : num [1:1108163] 446 1048 252 357 1007 ...
##  $ from_station_id  : num [1:1108163] 81 317 283 26 202 420 503 260 211 211 ...
##  $ from_station_name: chr [1:1108163] "Daley Center Plaza" "Wood St & Taylor St" "LaSalle St & Jacks
##  $ to_station_id    : num [1:1108163] 56 59 174 133 129 426 500 499 211 211 ...
##  $ to_station_name  : chr [1:1108163] "Desplaines St & Kinzie St" "Wabash Ave & Roosevelt Rd" "Canal
##  $ usertype         : chr [1:1108163] "Subscriber" "Subscriber" "Subscriber" "Subscriber" ...
##  $ gender           : chr [1:1108163] "Male" "Female" "Male" "Male" ...
##  $ birthyear        : 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>
```

```r
str(Q3_2019)
```

```
## spec_tbl_df [1,640,718 x 12] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ trip_id          : num [1:1640718] 23479388 23479389 23479390 23479391 23479392 ...
##  $ start_time       : POSIXct[1:1640718], format: "2019-07-01 00:00:27" "2019-07-01 00:01:16" ...
##  $ end_time         : POSIXct[1:1640718], format: "2019-07-01 00:20:41" "2019-07-01 00:18:44" ...
##  $ bikeid           : num [1:1640718] 3591 5353 6180 5540 6014 ...
##  $ tripduration     : num [1:1640718] 1214 1048 1554 1503 1213 ...
##  $ from_station_id  : num [1:1640718] 117 381 313 313 168 300 168 313 43 43 ...
##  $ from_station_name: chr [1:1640718] "Wilton Ave & Belmont Ave" "Western Ave & Monroe St" "Lakeview
##  $ to_station_id    : num [1:1640718] 497 203 144 144 62 232 62 144 195 195 ...
##  $ to_station_name  : chr [1:1640718] "Kimball Ave & Belmont Ave" "Western Ave & 21st St" "Larrabee S
##  $ usertype         : 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(Q4_2019)
```

```
## spec_tbl_df [704,054 x 12] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ trip_id          : num [1:704054] 25223640 25223641 25223642 25223643 25223644 ...
##  $ start_time       : POSIXct[1:704054], format: "2019-10-01 00:01:39" "2019-10-01 00:02:16" ...
##  $ end_time         : POSIXct[1:704054], format: "2019-10-01 00:17:20" "2019-10-01 00:06:34" ...
##  $ bikeid           : num [1:704054] 2215 6328 3003 3275 5294 ...
##  $ tripduration     : num [1:704054] 940 258 850 2350 1867 ...
##  $ from_station_id  : num [1:704054] 20 19 84 313 210 156 84 156 156 336 ...
##  $ from_station_name: chr [1:704054] "Sheffield Ave & Kingsbury St" "Throop (Loomis) St & Taylor St"
##  $ to_station_id    : num [1:704054] 309 241 199 290 382 226 142 463 463 336 ...
##  $ to_station_name  : chr [1:704054] "Leavitt St & Armitage Ave" "Morgan St & Polk St" "Wabash Ave &
##  $ usertype         : 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>
```

```
colnames(Q1_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] "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(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"
```

**Combine the quarterly data into one dataset for the entire year**

```
all_2019 <- bind_rows(Q1_2019, Q2_2019, Q3_2019, Q4_2019)
```

**Use the summary() function to visually inspect the hoined dataset**

```
summary(all_2019)
```

```
##     trip_id           start_time                    end_time
##  Min.   :21742443   Min.   :2019-01-01 00:04:37   Min.   :2019-01-01 00:11:07
##  1st Qu.:22873787   1st Qu.:2019-05-29 15:49:26   1st Qu.:2019-05-29 16:09:28
##  Median :23962320   Median :2019-07-25 17:50:54   Median :2019-07-25 18:12:23
##  Mean   :23915629   Mean   :2019-07-19 21:47:37   Mean   :2019-07-19 22:11:47
##  3rd Qu.:24963703   3rd Qu.:2019-09-15 06:48:05   3rd Qu.:2019-09-15 08:30:13
##  Max.   :25962904   Max.   :2019-12-31 23:57:17   Max.   :2020-01-21 13:54:35
##
##      bikeid      tripduration      from_station_id from_station_name
##  Min.   :   1   Min.   :      61   Min.   :  1.0   Length:3818004
##  1st Qu.:1727   1st Qu.:     411   1st Qu.: 77.0   Class :character
##  Median :3451   Median :     709   Median :174.0   Mode  :character
##  Mean   :3380   Mean   :    1450   Mean   :201.7
##  3rd Qu.:5046   3rd Qu.:    1283   3rd Qu.:289.0
##  Max.   :6946   Max.   :10628400   Max.   :673.0
##
##  to_station_id   to_station_name      usertype           gender
##  Min.   :  1.0   Length:3818004     Length:3818004     Length:3818004
##  1st Qu.: 77.0   Class :character   Class :character   Class :character
##  Median :174.0   Mode  :character   Mode  :character   Mode  :character
##  Mean   :202.6
```

```
##  3rd Qu.:291.0
##  Max.   :673.0
##
##    birthyear
##  Min.   :1759
##  1st Qu.:1979
##  Median :1987
##  Mean   :1984
##  3rd Qu.:1992
##  Max.   :2014
##  NA's   :538751
```

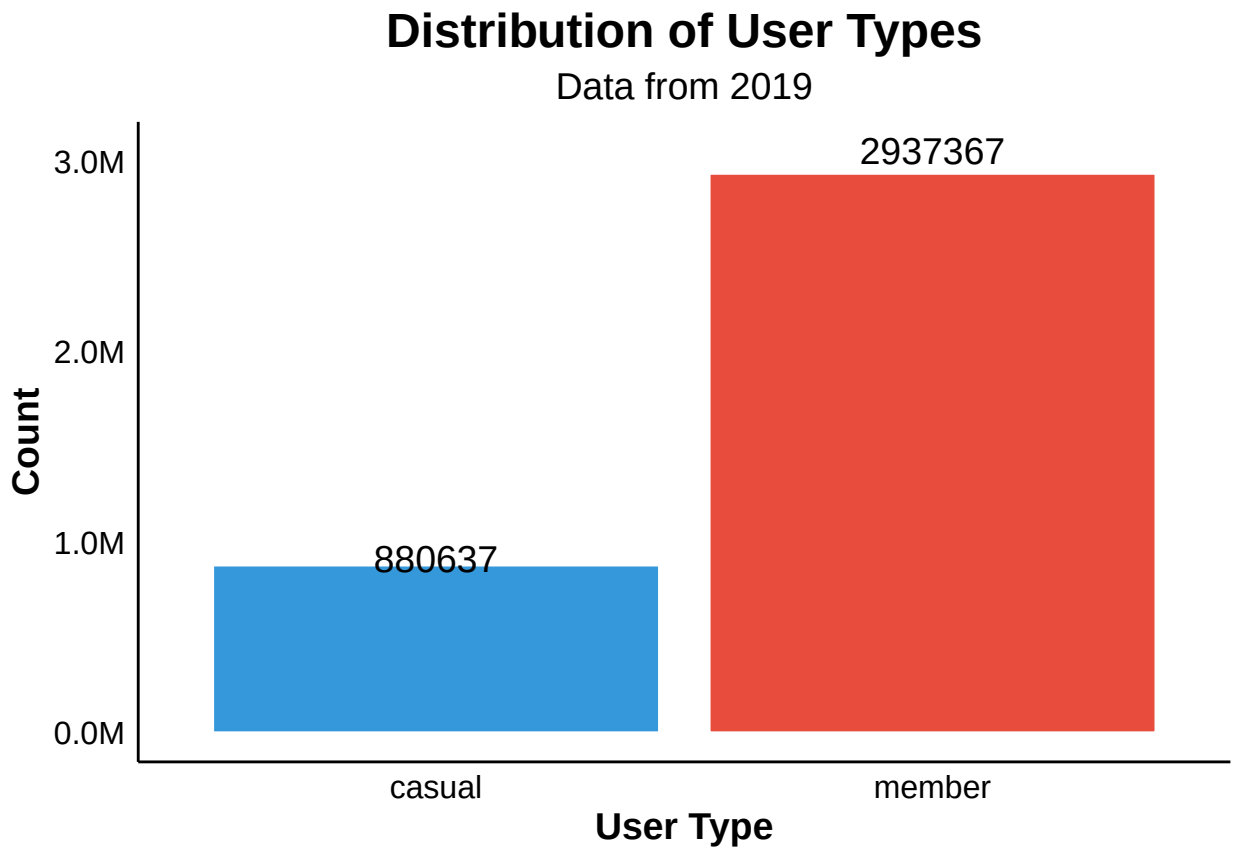
```
dim(all_2019)
```

```
## [1] 3818004      12
```

```
all_2019 <-  all_2019 %>%
  mutate(usertype = recode(usertype
                           ,"Subscriber" = "member"
                           ,"Customer" = "casual"))
```

**Use graphics to check the contents in the usertpe column**

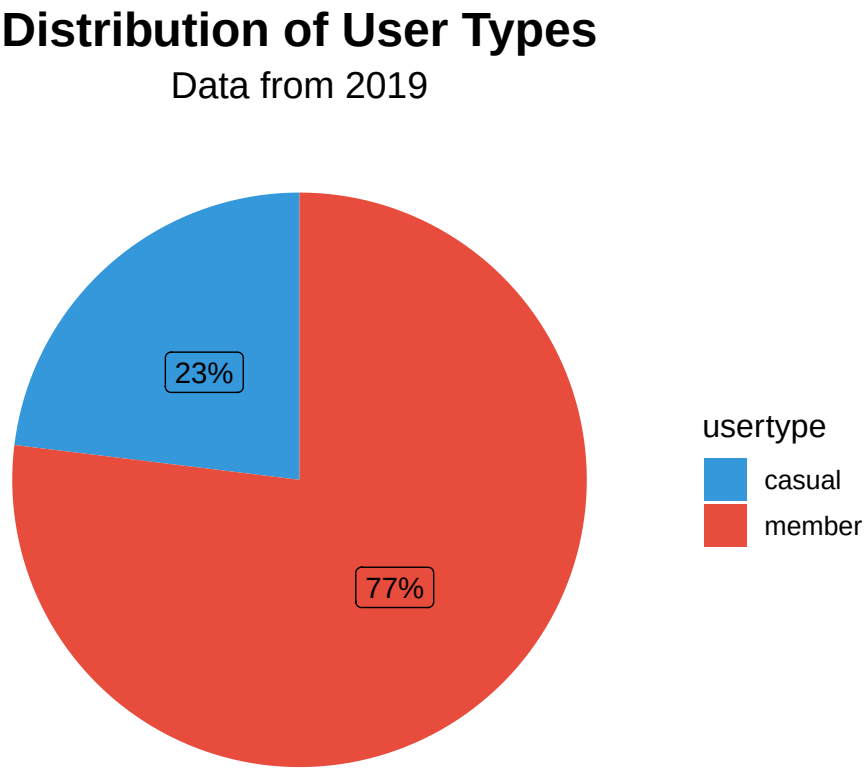
```
ggplot(all_2019, aes(x = usertype, fill = usertype)) +
  geom_bar(color = "white", position = "stack", show.legend = FALSE) +
  geom_text(stat = "count", aes(label = stat(count)),
            position = position_stack(vjust = 1.04), size = 5) +
  labs(title = "Distribution of User Types",
       subtitle = "Data from 2019",
       x = "User Type",
       y = "Count") +
  theme_minimal() +
  theme(panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
        axis.line = element_line(color = "black"),
        text = element_text(size = 12),
        plot.title = element_text(hjust = 0.5, size = 18, face = "bold"),
        plot.subtitle = element_text(hjust = 0.5, size = 14),
        axis.title = element_text(size = 14, face = "bold"),
        axis.text = element_text(size = 12, color = "black")) +
  scale_fill_manual(values = c("#3498db", "#e74c3c")) +
  scale_y_continuous(labels = scales::number_format(scale = 1e-6, suffix = "M"))
```




```
df <- all_2019 %>%
  group_by(usertype) %>%
  count() %>%
  ungroup() %>%
  mutate(perc = `n` / sum(`n`)) %>%
  arrange(perc) %>%
  mutate(labels = scales::percent(perc))

ggplot(df, aes(x = "", y = perc, fill = usertype)) +
  geom_col() +
  geom_label(aes(label = labels),
             position = position_stack(vjust = 0.5),
             show.legend = FALSE) +
  labs(title = "Distribution of User Types",
       subtitle = "Data from 2019",
       x = "",
       y = "") +
  coord_polar(theta = "y")+
  theme_minimal() +
  theme(panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
        axis.line = element_blank(),
        text = element_text(size = 12),
        plot.title = element_text(hjust = 0.5, size = 18, face = "bold"),
        plot.subtitle = element_text(hjust = 0.5, size = 14),
```

```
        axis.title = element_blank(),
        axis.text = element_blank()) +
  scale_fill_manual(values = c("#3498db", "#e74c3c"))
```




**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**

```
all_2019$date <- as.Date(all_2019$start_time) #The default format is yyyy-mm-dd
all_2019$month <- format(as.Date(all_2019$date), "%m")
all_2019$day <- format(as.Date(all_2019$date), "%d")
all_2019$year <- format(as.Date(all_2019$date), "%Y")
all_2019$day_of_week <- format(as.Date(all_2019$date), "%A")
```

**Descriptive analysis on ride_length (all figures in seconds)**

```
summary(all_2019$tripduration)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
##        61       411       709      1450      1283  10628400
```

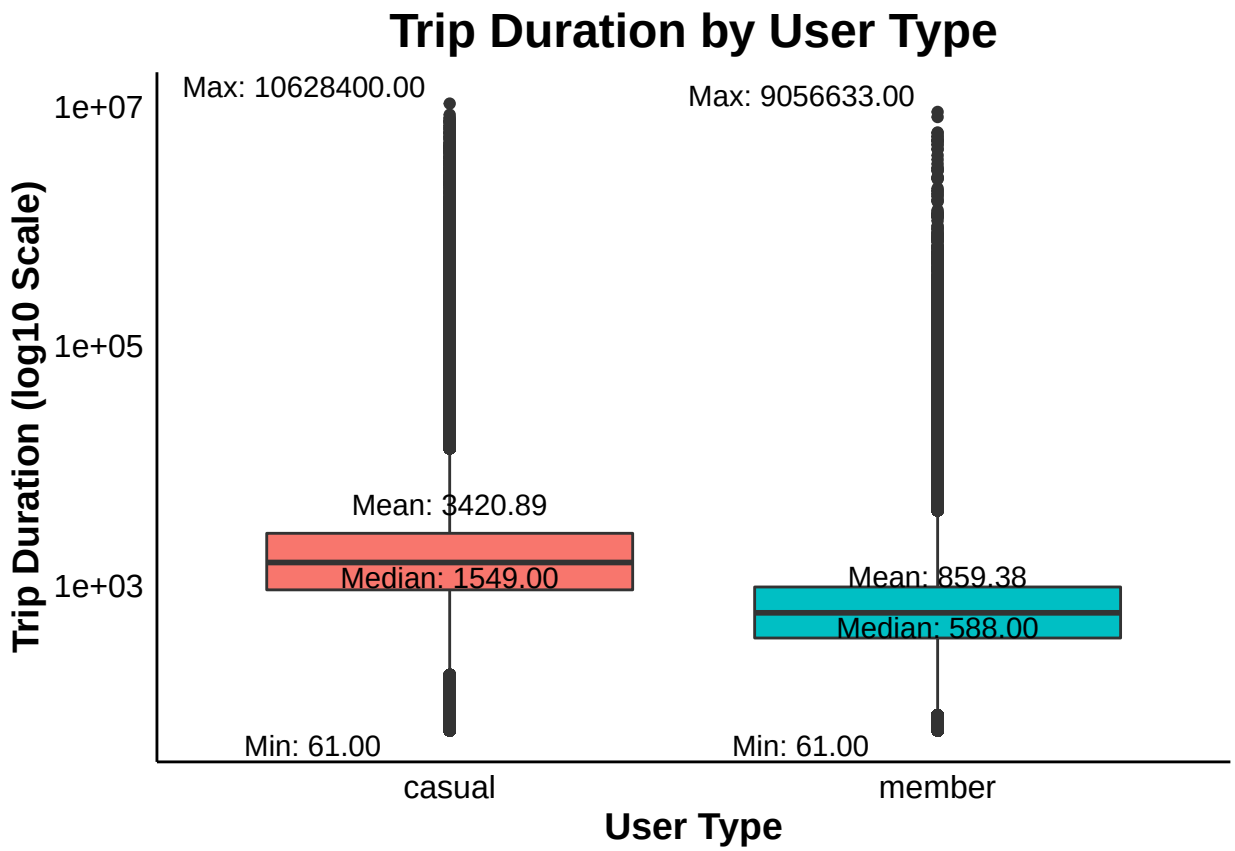
**Compare members and casual users**

```
summary_stats <- all_2019 %>%
  group_by(usertype) %>%
  summarize(mean_duration = mean(tripduration),
            median_duration = median(tripduration),
            max_duration = max(tripduration),
            min_duration = min(tripduration))


print(summary_stats)
```

```
## # A tibble: 2 x 5
##   usertype mean_duration median_duration max_duration min_duration
##   <chr>            <dbl>           <dbl>        <dbl>        <dbl>
## 1 casual           3421.            1549     10628400           61
## 2 member            859.             588      9056633           61
```

```
ggplot(all_2019, aes(x = usertype, y = tripduration, fill = usertype)) +
  geom_boxplot(show.legend = FALSE) +
  geom_text(data = summary_stats,
            aes(x = usertype, y = mean_duration, label = sprintf("Mean: %.2f", mean_duration)),
            vjust = -0.3, hjust = 0.5, color = "black") +
  geom_text(data = summary_stats,
            aes(x = usertype, y = median_duration, label = sprintf("Median: %.2f", median_duration)),
            vjust = 1.2, hjust = 0.5, color = "black") +
  geom_text(data = summary_stats,
            aes(x = usertype, y = max_duration, label = sprintf("Max: %.2f", max_duration)),
            vjust = -0.3, hjust = 1.1, color = "black") +
  geom_text(data = summary_stats,
            aes(x = usertype, y = min_duration, label = sprintf("Min: %.2f", min_duration)),
            vjust = 1.2, hjust = 1.5, color = "black") +
  labs(title = "Trip Duration by User Type",
       x = "User Type",
       y = "Trip Duration (log10 Scale)") +
  scale_y_log10() +
  theme_minimal() +
  theme(panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
        axis.line = element_line(color = "black"),
        text = element_text(size = 12),
        plot.title = element_text(hjust = 0.5, size = 18, face = "bold"),
        axis.title = element_text(size = 14, face = "bold"),
        axis.text = element_text(size = 12, color = "black"))
```



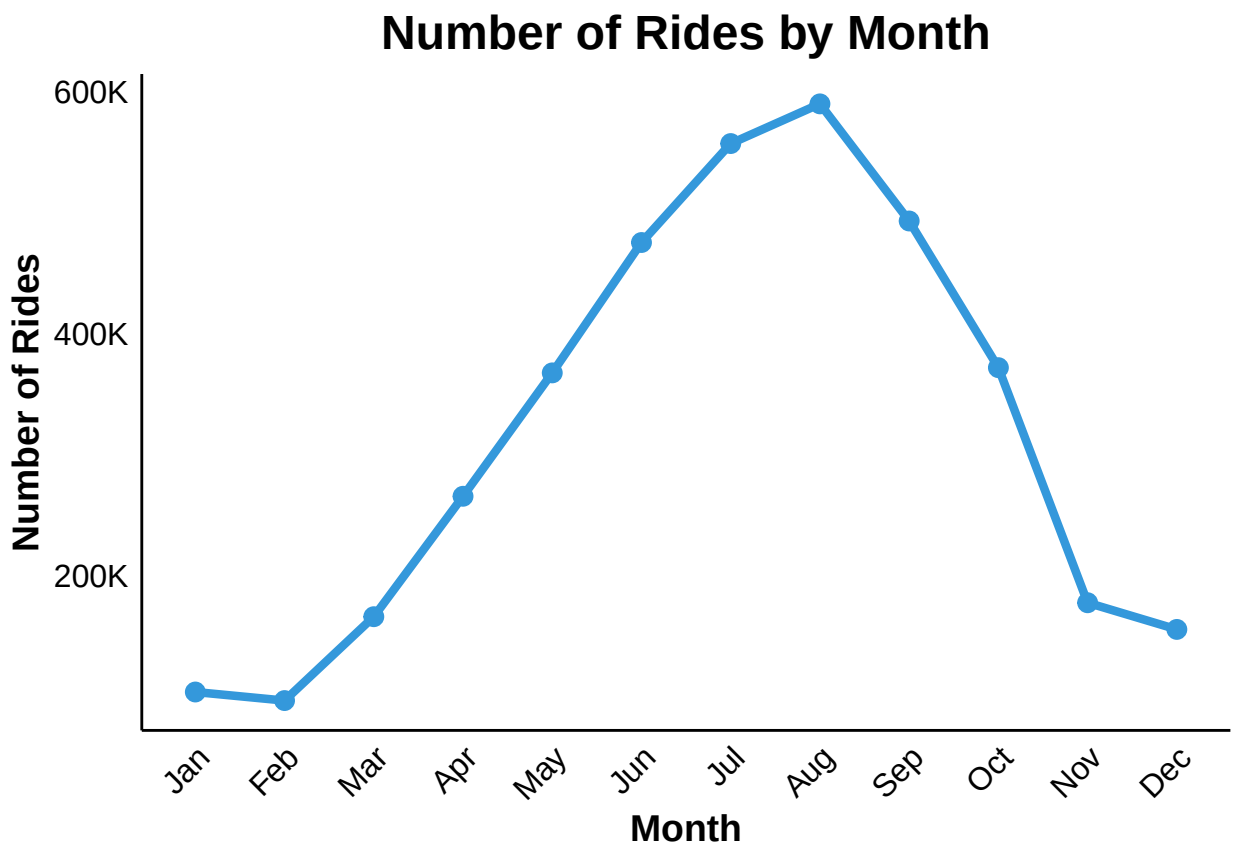

```
colnames(all_2019)
```

```
##  [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"
## [13] "date"              "month"             "day"
## [16] "year"              "day_of_week"
```

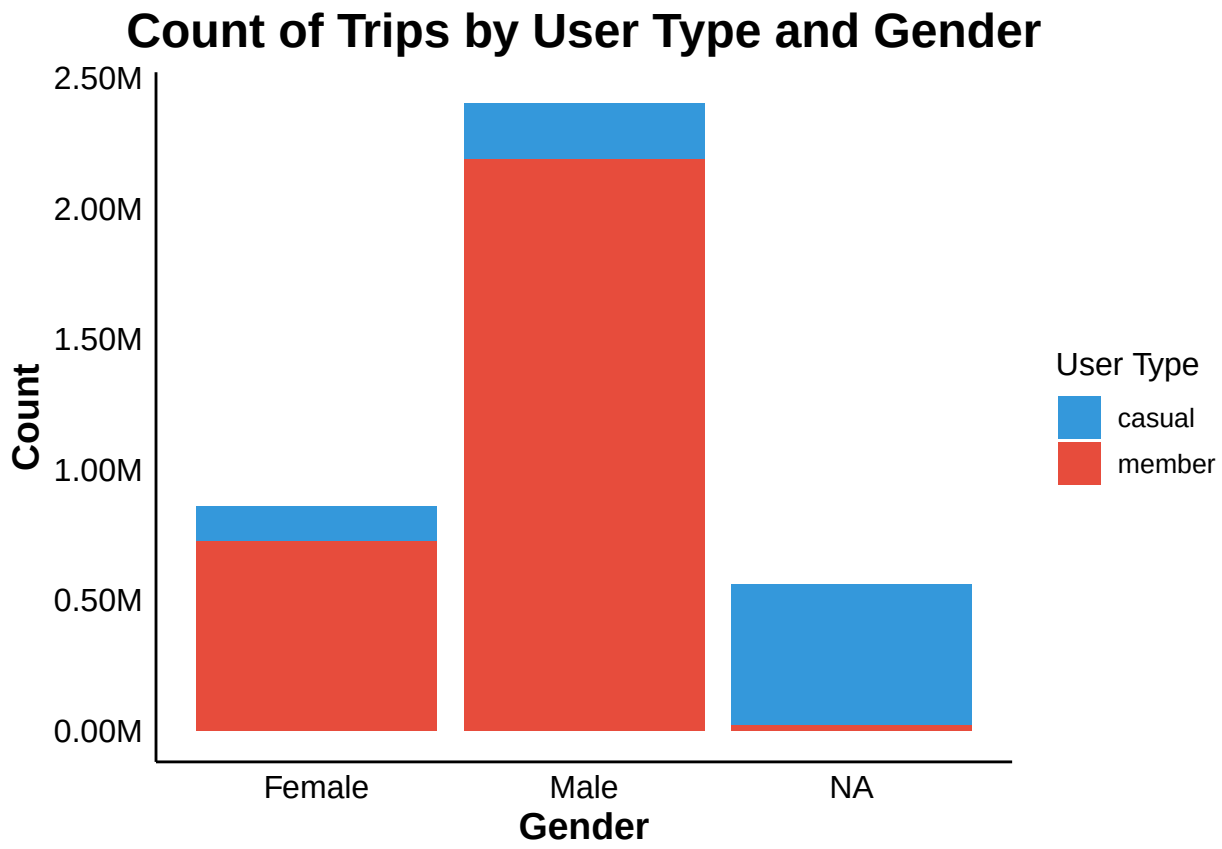
```
rides_by_month <- all_2019 %>%
  group_by(month) %>%
  summarise(number_of_rides = n())

ggplot(rides_by_month, aes(x = month, y = number_of_rides, group = 1)) +
  geom_line(color = "#3498db", size = 1.5) +
  geom_point(color = "#3498db", size = 3) +
  labs(title = "Number of Rides by Month",
       x = "Month",
       y = "Number of Rides") +
  scale_x_discrete(labels = month.abb) +
  theme_minimal() +
  theme_minimal() +
  theme(panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
```

```
        axis.line = element_line(color = "black"),
        text = element_text(size = 12),
        plot.title = element_text(hjust = 0.5, size = 18, face = "bold"),
        plot.subtitle = element_text(hjust = 0.5, size = 14),
        axis.title = element_text(size = 14, face = "bold"),
        axis.text = element_text(size = 12, color = "black")) +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust = 1))+
  scale_y_continuous(labels = scales::number_format(scale = 1e-3, suffix = "K"))
```




```
ggplot(all_2019, aes(x = gender, fill = usertype)) +
  geom_bar() +
  labs(title = "Count of Trips by User Type and Gender", x = "Gender", y = "Count", fill = "User Type") +
  theme_minimal()+
  theme(panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
        axis.line = element_line(color = "black"),
        text = element_text(size = 12),
        plot.title = element_text(hjust = 0.5, size = 18, face = "bold"),
        axis.title = element_text(size = 14, face = "bold"),
        axis.text = element_text(size = 12, color = "black"),
        legend.position = "right") +
  scale_fill_manual(values = c("#3498db", "#e74c3c")) +
  scale_y_continuous(labels = scales::number_format(scale = 1e-6, suffix = "M"))
```




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

```
aggregate(all_2019$tripduration ~ all_2019$usertype + all_2019$day_of_week, FUN = mean)
```

```
##    all_2019$usertype all_2019$day_of_week all_2019$tripduration
## 1             casual               Friday             3610.3514
## 2             member               Friday              833.5801
## 3             casual               Monday             3269.7334
## 4             member               Monday              854.6510
## 5             casual             Saturday             3243.5687
## 6             member             Saturday              977.9140
## 7             casual               Sunday             3370.8448
## 8             member               Sunday              923.8375
## 9             casual             Thursday             3596.7864
## 10            member             Thursday              826.5039
## 11            casual              Tuesday             3444.5548
## 12            member              Tuesday              848.8744
## 13            casual            Wednesday             3619.9636
## 14            member            Wednesday              828.3104
```

### Ordering days of the week

```
all_2019$day_of_week <- ordered(all_2019$day_of_week, levels=c( "Monday", "Tuesday", "Wednesday", "Thurs

aggregate(all_2019$tripduration ~ all_2019$usertype + all_2019$day_of_week, FUN = mean)
```

```
##    all_2019$usertype all_2019$day_of_week all_2019$tripduration
## 1             casual                Monday             3269.7334
## 2             member                Monday              854.6510
## 3             casual               Tuesday             3444.5548
## 4             member               Tuesday              848.8744
## 5             casual             Wednesday             3619.9636
## 6             member             Wednesday              828.3104
## 7             casual              Thursday             3596.7864
## 8             member              Thursday              826.5039
## 9             casual                Friday             3610.3514
## 10            member                Friday              833.5801
## 11            casual              Saturday             3243.5687
## 12            member              Saturday              977.9140
## 13            casual                Sunday             3370.8448
## 14            member                Sunday              923.8375
```

### Analyze ridership data by type and weekday

```
all_2019 %>%
  mutate(weekday = wday(start_time, label = TRUE)) %>%  #creates weekday field using wday()
  group_by(usertype, weekday) %>%  #groups by usertype and weekday
  summarise(number_of_rides = n(),average_duration = mean(tripduration)) %>% #calculates number of rides
  arrange(usertype, weekday) #sorts
```

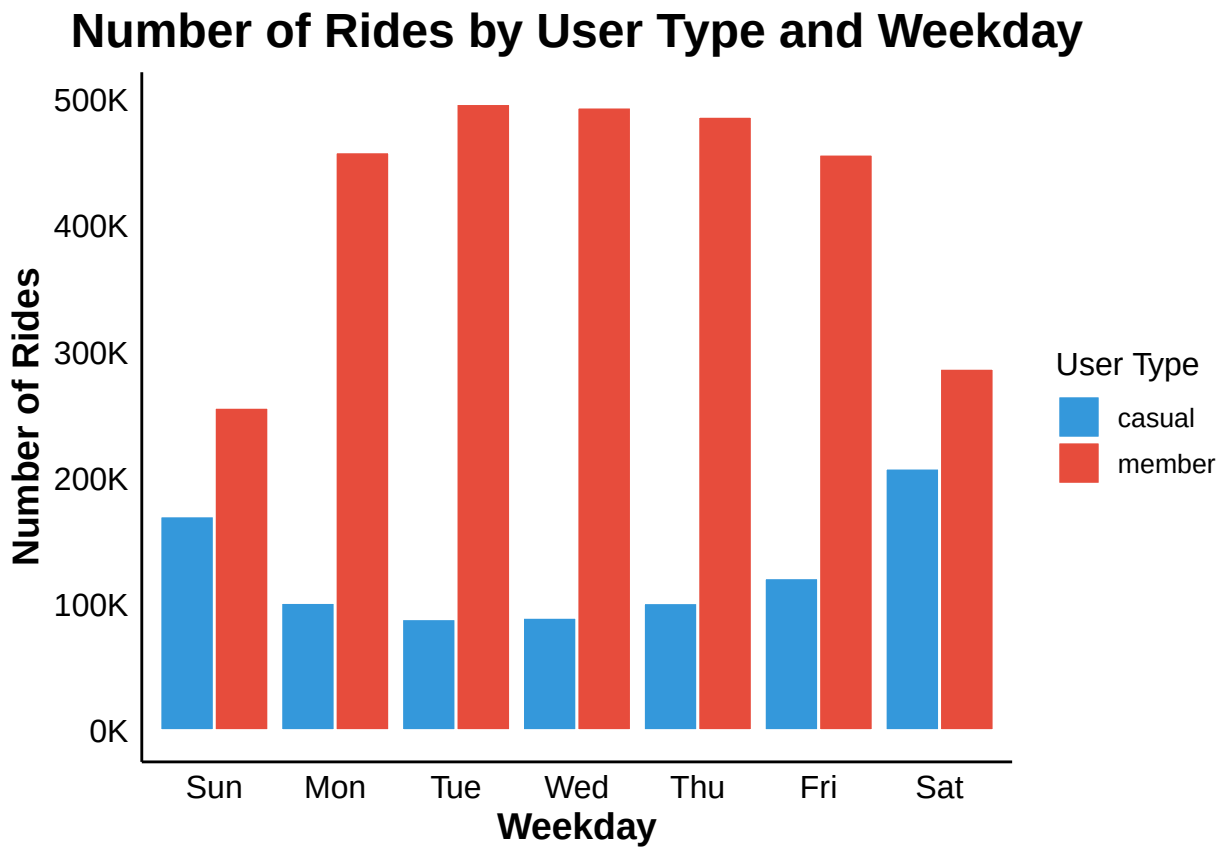
```
## `summarise()` has grouped output by 'usertype'. You can override using the `.groups` argument.
```

```
## # A tibble: 14 x 4
## # Groups:   usertype [2]
##    usertype weekday number_of_rides average_duration
##    <chr>    <ord>             <int>            <dbl>
##  1 casual   Sun              170179            3371.
##  2 casual   Mon              101489            3270.
##  3 casual   Tue               88655            3445.
##  4 casual   Wed               89745            3620.
##  5 casual   Thu              101372            3597.
##  6 casual   Fri              121141            3610.
##  7 casual   Sat              208056            3244.
##  8 member   Sun              256241             924.
##  9 member   Mon              458780             855.
## 10 member   Tue              497025             849.
## 11 member   Wed              494277             828.
## 12 member   Thu              486915             827.
## 13 member   Fri              456966             834.
## 14 member   Sat              287163             978.
```

**Visualize the number of rides by rider type**

```
all_2019 %>%
  mutate(weekday = wday(start_time, label = TRUE)) %>%
  group_by(usertype, weekday) %>%
  summarise(number_of_rides = n(), average_duration = mean(tripduration)) %>%
  arrange(usertype, weekday) %>%
  ggplot(aes(x = weekday, y = number_of_rides, fill = usertype)) +
  geom_col(position = "dodge", color = "white", size = 0.5) +
  labs(title = "Number of Rides by User Type and Weekday",
       x = "Weekday",
       y = "Number of Rides",
       fill = "User Type") +
  theme_minimal() +
  theme(panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
        axis.line = element_line(color = "black"),
        text = element_text(size = 12),
        plot.title = element_text(hjust = 0.5, size = 18, face = "bold"),
        axis.title = element_text(size = 14, face = "bold"),
        axis.text = element_text(size = 12, color = "black"),
        legend.position = "right") +
  scale_fill_manual(values = c("#3498db", "#e74c3c")) +
  scale_y_continuous(labels = scales::number_format(scale = 1e-3, suffix = "K"))
```

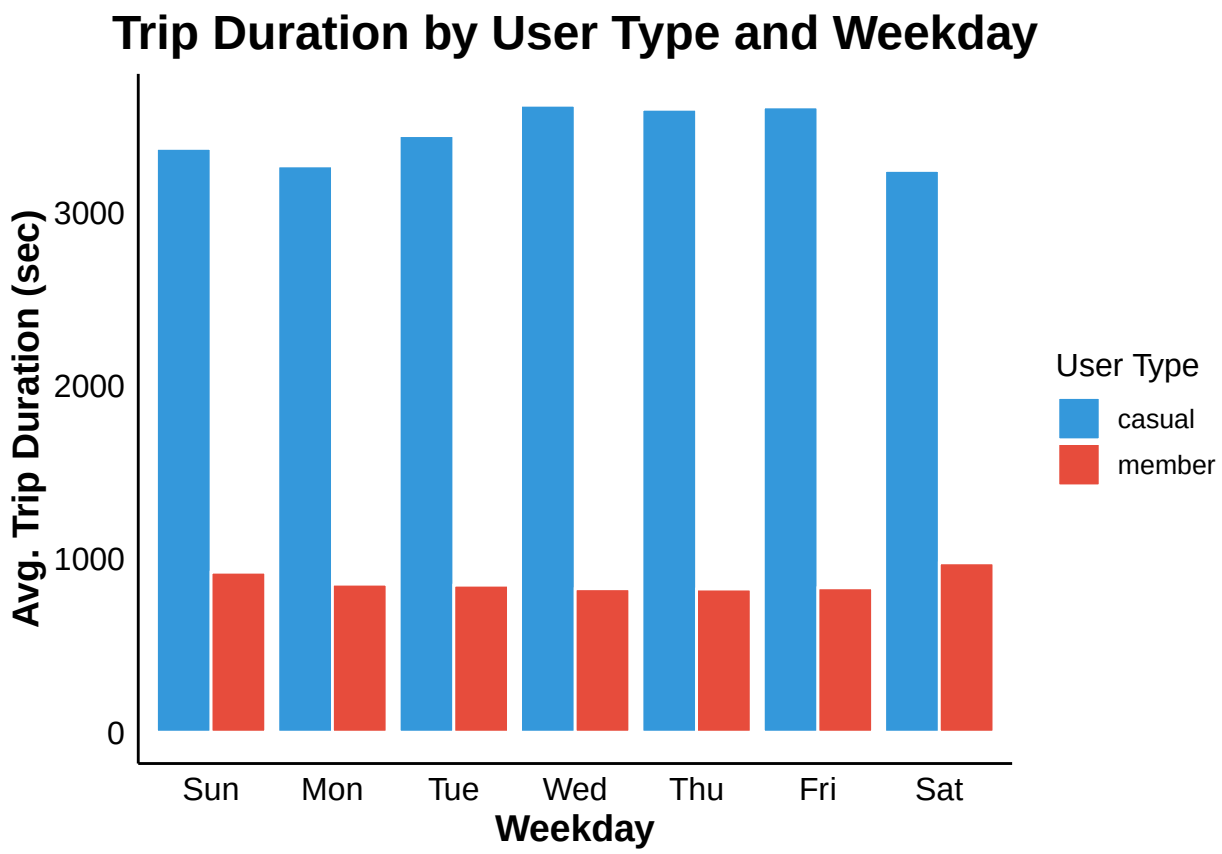
```
## `summarise()` has grouped output by 'usertype'. You can override using the `.groups` argument.
```




**Let's create a visualization for average duration**

```
all_2019 %>%
  mutate(weekday = wday(start_time, label = TRUE)) %>%
  group_by(usertype, weekday) %>%
  summarise(number_of_rides = n(), average_duration = mean(tripduration)) %>%
  arrange(usertype, weekday) %>%
  ggplot(aes(x = weekday, y = average_duration, fill = usertype)) +
  geom_col(position = "dodge", color = "white", size = 0.5) +
  labs(title = "Trip Duration by User Type and Weekday",
       x = "Weekday",
       y = "Avg. Trip Duration (sec)",
       fill = "User Type") +
  theme_minimal() +
  theme(panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
        axis.line = element_line(color = "black"),
        text = element_text(size = 12),
        plot.title = element_text(hjust = 0.5, size = 18, face = "bold"),
        axis.title = element_text(size = 14, face = "bold"),
        axis.text = element_text(size = 12, color = "black"),
        legend.position = "right") +
  scale_fill_manual(values = c("#3498db", "#e74c3c"))
```

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




**Do statistical test to see if the difference in tripduration is significance**

```r
user_type1_data <- all_2019$tripduration[all_2019$usertype == "member"]
user_type2_data <- all_2019$tripduration[all_2019$usertype == "casual"]

t_test_result <- t.test(user_type1_data, user_type2_data)

print(t_test_result)
```

```
##
##  Welch Two Sample t-test
##
## data:  user_type1_data and user_type2_data
## t = -42.742, df = 920075, p-value < 2.2e-16
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -2678.962 -2444.043
## sample estimates:
## mean of x mean of y
##  859.3833 3420.8857
```

**Import data for future use into a table**

```
counts <- aggregate(all_2019$tripduration ~ all_2019$usertype + all_2019$day_of_week, FUN = mean)
head(counts)
```

```
##   all_2019$usertype all_2019$day_of_week all_2019$tripduration
## 1            casual                Monday             3269.7334
## 2            member                Monday              854.6510
## 3            casual               Tuesday             3444.5548
## 4            member               Tuesday              848.8744
## 5            casual             Wednesday             3619.9636
## 6            member             Wednesday              828.3104
```

# Final observation

Based our analysis we see that while casual customers use bikes for a longer duration, subscribing members average more daily number of rides, especially on weekdays.