Data Cleaning - Cyclistic Capstone Project for GDAC

by María Braeuner 2021

The first part of this document details the steps to clean, transform & prepare the raw data from Cyclistic for analysis. The second part is the initial exploratory analysis. Final analysis/results in *CS1_Cyclistic_Report.Pdf*.

Preparing

Load Necessary Packages

```
library(tidyverse)
library(lubridate) #date functions
```

Import Data

```
#Load Data

Nov20 <- read_csv("Data/202011-divvy-tripdata.csv")
Dec20 <- read_csv("Data/202012-divvy-tripdata.csv")
Jan21 <- read_csv("Data/202101-divvy-tripdata.csv")
Feb21 <- read_csv("Data/202102-divvy-tripdata.csv")
Mar21 <- read_csv("Data/202103-divvy-tripdata.csv")
Apr21 <- read_csv("Data/202104-divvy-tripdata.csv")
May21 <- read_csv("Data/202105-divvy-tripdata.csv")
Jun21 <- read_csv("Data/202106-divvy-tripdata.csv")
Jul21 <- read_csv("Data/202107-divvy-tripdata.csv")
Ago21 <- read_csv("Data/202108-divvy-tripdata.csv")
Sep21 <- read_csv("Data/202109-divvy-tripdata.csv")
Oct21 <- read_csv("Data/202110-divvy-tripdata.csv")

#Check all df's have the same structure: check if all column names
#are the same (e.g. to make it easier to merge into one dataframe)
colnames(Nov20) == colnames(Dec20)
colnames(Nov20) == colnames(Jan21)
colnames(Nov20) == colnames(Feb21)
colnames(Nov20) == colnames(Mar21)
colnames(Nov20) == colnames(Apr21)
colnames(Nov20) == colnames(May21)
colnames(Nov20) == colnames(Jun21)
colnames(Nov20) == colnames(Jul21)
colnames(Nov20) == colnames(Ago21)
colnames(Nov20) == colnames(Sep21)
colnames(Nov20) == colnames(Oct21)
# all TRUE - looks good
```

The data available for each df: ride_id, rideable_type, started_at, ended_at, start_station_name, start_station_id, end_station_name, end_station_id, start_lat, start_lng, end_lat, end_lng, member_casual

Merge Data

Merge 12 datasets into one.

```
cyclistic12 <- rbind(Nov20, Dec20, Jan21, Feb21,
                     Mar21, Apr21, May21, Jun21,
                     Jul21, Ago21, Sep21, Oct21)

#Check:
head(cyclistic12)
tail(cyclistic12)
dim(cyclistic12) # 5,378,834 x 13
```

Clean & prepare data for analysis

```
#check for data types
glimpse(cyclistic12) #rideable_type & member_casual are as chr, change to factors
cyclistic12$rideable_type <- as.factor(cyclistic12$rideable_type)
cyclistic12$member_casual <- as.factor(cyclistic12$member_casual)
glimpse(cyclistic12) #looks ok
```

```
summary(cyclistic12)
```

```
##    ride_id                rideable_type       started_at
##  Length:5378834     classic_bike :3066970   Min.   :2020-11-01 00:00:08
##  Class :character   docked_bike  : 464387   1st Qu.:2021-05-17 12:45:18
##  Mode  :character   electric_bike:1847477   Median :2021-07-13 22:33:14
##                                             Mean   :2021-06-27 18:37:41
##                                             3rd Qu.:2021-09-02 18:18:14
##                                             Max.   :2021-10-31 23:59:49
##
##     ended_at                   start_station_name start_station_id
##  Min.   :2020-11-01 00:02:20   Length:5378834     Length:5378834
##  1st Qu.:2021-05-17 13:07:36   Class :character   Class :character
##  Median :2021-07-13 22:57:23   Mode  :character   Mode  :character
##  Mean   :2021-06-27 18:58:10
##  3rd Qu.:2021-09-02 18:35:16
##  Max.   :2021-11-03 21:45:48
##
##  end_station_name   end_station_id       start_lat       start_lng
##  Length:5378834     Length:5378834     Min.   :41.64   Min.   :-87.84
##  Class :character   Class :character   1st Qu.:41.88   1st Qu.:-87.66
##  Mode  :character   Mode  :character   Median :41.90   Median :-87.64
##                                        Mean   :41.90   Mean   :-87.65
##                                        3rd Qu.:41.93   3rd Qu.:-87.63
##                                        Max.   :42.08   Max.   :-87.52
##
##     end_lat         end_lng       member_casual
##  Min.   :41.51   Min.   :-88.07   casual:2470517
##  1st Qu.:41.88   1st Qu.:-87.66   member:2908317
##  Median :41.90   Median :-87.64
##  Mean   :41.90   Mean   :-87.65
##  3rd Qu.:41.93   3rd Qu.:-87.63
##  Max.   :42.17   Max.   :-87.44
##  NA's   :4831    NA's   :4831
```

Important details to note:

- ended_at includes 3 days of November 2021 (remove these)
- end_lat & end_lang have 4831 NA's
- rideable_type categories: classic_bike, docked_bike, electric_bike
- member_casual categories: member & casual

```
length(unique(cyclistic12$start_station_name)) #check how many stations (815)
length(unique(cyclistic12$end_station_name)) #check how many stations (812)

#filter out the extra days of Nov2021
cyclistic <- cyclistic12 %>%
  filter(ended_at <= "2021-11-01 00:00:00")

summary(cyclistic)
dim(cyclistic) #5,378.531 x 13 - ok

#Add new columns for: Day, Month, Year, DayOfWeek (dow), time of day (tod) & tod_char, Season, ride_len
cyclistic$date <- as.Date(cyclistic$started_at) #yyyy-mm-dd
cyclistic$month <- format(as.Date(cyclistic$date), "%m")
cyclistic$month <- as.numeric(cyclistic$month) #helps to create Seasons column;
cyclistic$day <- format(as.Date(cyclistic$date), "%d")
cyclistic$year <- format(as.Date(cyclistic$date), "%Y")
cyclistic$dow <- format(as.Date(cyclistic$date), "%A")
cyclistic$tod <- format(cyclistic$started_at, "%H:%M:%S")
cyclistic$ride_length <- difftime(cyclistic$ended_at, cyclistic$started_at) #in seconds
cyclistic$ride_length <- as.numeric(cyclistic$ride_length)
cyclistic$ride_length_min <- cyclistic$ride_length/60 #in min

cyclistic$season <- "Winter"
cyclistic$season[cyclistic$month>2&cyclistic$month<6] <- "Spring"
cyclistic$season[cyclistic$month>5&cyclistic$month<9] <- "Summer"
cyclistic$season[cyclistic$month>8&cyclistic$month<12] <- "Autumn"
cyclistic$season <- as.factor(cyclistic$season)
summary(cyclistic$season)

# Reference used here:
##Morning=[05:00-11:59] ; Afternoon=[12:00-17:59] ; Evening=[18:00-21:59] ; Night=[22:00-04:59]

tod_char <- format(cyclistic$started_at, "%H")
tod_char <- as.numeric(tod_char)
cyclistic$tod_char <- "Night"
cyclistic$tod_char[tod_char<12&tod_char>=5] <- "Morning"
cyclistic$tod_char[tod_char>=18&tod_char<22] <- "Evening"
cyclistic$tod_char[tod_char>=12&tod_char<18] <- "Afternoon"
cyclistic$tod_char <- as.factor(cyclistic$tod_char)

summary(cyclistic$tod_char)
glimpse(cyclistic)

summary(cyclistic) #there are negative ride_length vals.

cyclistic[cyclistic$ride_length_min <0, ] # 1393 negatives; started_at & ended_at could be inverted, bu

##Exclude these rows.
```

```r
Cyclistic_Data <- cyclistic[!cyclistic$ride_length <0, ]

dim(cyclistic) # 5378531 x 23
dim(Cyclistic_Data) # 5377138 x 23
# 5378531 - 5377138 = 1393 = ok

#ride_id should not have duplicates:
length(Cyclistic_Data$ride_id) #5377138
n_distinct(Cyclistic_Data$ride_id) #5377138 ok!

max(Cyclistic_Data$ride_length_min) #55944.14, this is over 38 days.
#how many ride lenghts exceed 24 hours?
Cyclistic_Data %>%
  summarize(weird_lengths = which(ride_length_min>1440))
#there are 3,800 trips of over 24 hours
# who's doing 24+? Check:
long_rides <- Cyclistic_Data %>%
  group_by(member_casual) %>%
  summarize(Long_Ride_Length = which(ride_length_min>1440))

long_rides <- long_rides %>%
  group_by(member_casual) %>%
  summarize(n = n(),
            mean_duration_minutes = mean(Long_Ride_Length))

#Station names have some that were tests and some NAs
##Remove testing rows. Leave NAs for now (some don't have station name but lat,lon)
CyclisticData <- Cyclistic_Data[!grepl("TEST",Cyclistic_Data$start_station_name), ]

CyclisticData <- CyclisticData[!grepl("TEST",CyclisticData$end_station_name), ]

CyclisticData <- CyclisticData[!grepl("TEST",CyclisticData$start_station_id), ]

CyclisticData <- CyclisticData[!grepl("TEST",CyclisticData$end_station_id), ]

rideable_type_check <- CyclisticData %>%
  group_by(month, year) %>%
  select(rideable_type, month, year) %>%
  count(rideable_type)

rideable_type_check

#order dow by dow instead of alphabetically:
CyclisticData$dow <- ordered(CyclisticData$dow, levels=c("Monday",
                                                         "Tuesday",
                                                         "Wednesday",
                                                         "Thursday",
                                                         "Friday",
                                                         "Saturday",
                                                         "Sunday"))


#order season
```

```
CyclisticData$season <- ordered(CyclisticData$season,
                                levels=c("Winter",
                                         "Spring",
                                         "Summer",
                                         "Autumn"))
```

Keep in mind for analysis:

- Rideable_type for November 2020 includes only 2 categories: docked and electric; "classic_bike" appears from December 2020 onward.
- Reference used for "Time of Day" (tod_char):
  - Morning = [05:00-11:59]
  - Afternoon = [12:00-17:59]
  - Evening = [18:00-21:59]
  - Night = [22:00-04:59]
- There are 3,800 trips of over 24 hours still included in the dataset (mean_duration_minutes = mean() of the length of all trips over 1440 minutes (24 hours), in minutes):

```
long_rides
```

```
## # A tibble: 2 x 3
##   member_casual     n mean_duration_minutes
## * <fct>         <int>                 <dbl>
## 1 casual         3343              1147415.
## 2 member          457              1443065.
```

Save cleaned data into a new .csv file.

Exploratory Data Analysis

```
head(CyclisticData)
```

```
## # A tibble: 6 x 23
##   ride_id rideable_type started_at          ended_at            start_station_n~
##   <chr>   <fct>         <dttm>              <dttm>              <chr>
## 1 BD0A6F~ electric_bike 2020-11-01 13:36:00 2020-11-01 13:45:40 Dearborn St & E~
## 2 96A7A7~ electric_bike 2020-11-01 10:03:26 2020-11-01 10:14:45 Franklin St & I~
## 3 C61526~ electric_bike 2020-11-01 00:34:05 2020-11-01 01:03:06 Lake Shore Dr &~
## 4 E533E8~ electric_bike 2020-11-01 00:45:16 2020-11-01 00:54:31 Leavitt St & Ch~
## 5 1C9F4E~ electric_bike 2020-11-01 15:43:25 2020-11-01 16:16:52 Buckingham Foun~
## 6 725958~ electric_bike 2020-11-14 15:55:17 2020-11-14 16:44:38 Wabash Ave & 16~
## # ... with 18 more variables: start_station_id <chr>, end_station_name <chr>,
## #   end_station_id <chr>, start_lat <dbl>, start_lng <dbl>, end_lat <dbl>,
## #   end_lng <dbl>, member_casual <fct>, date <date>, month <dbl>, day <chr>,
## #   year <chr>, dow <ord>, tod <chr>, ride_length <dbl>, ride_length_min <dbl>,
## #   season <ord>, tod_char <fct>
```

How do casual customers and members differ in # of rides & average ride duration (in minutes)?

```
## Ride length ($ride_length &/or $ride_length_min)

CyclisticData %>%
  group_by(member_casual) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min))
```

How do casual customers and members differ in # of rides & average ride duration (in minutes) by ride_type used?

```
## Type of ride they use ($rideable_type)
CyclisticData %>%
  group_by(member_casual, rideable_type) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min))
```

How do casual customers and members differ in # of rides & average ride duration (in minutes) by season?

```
## Use by $season
CyclisticData %>%
  group_by(member_casual, season) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min))
```

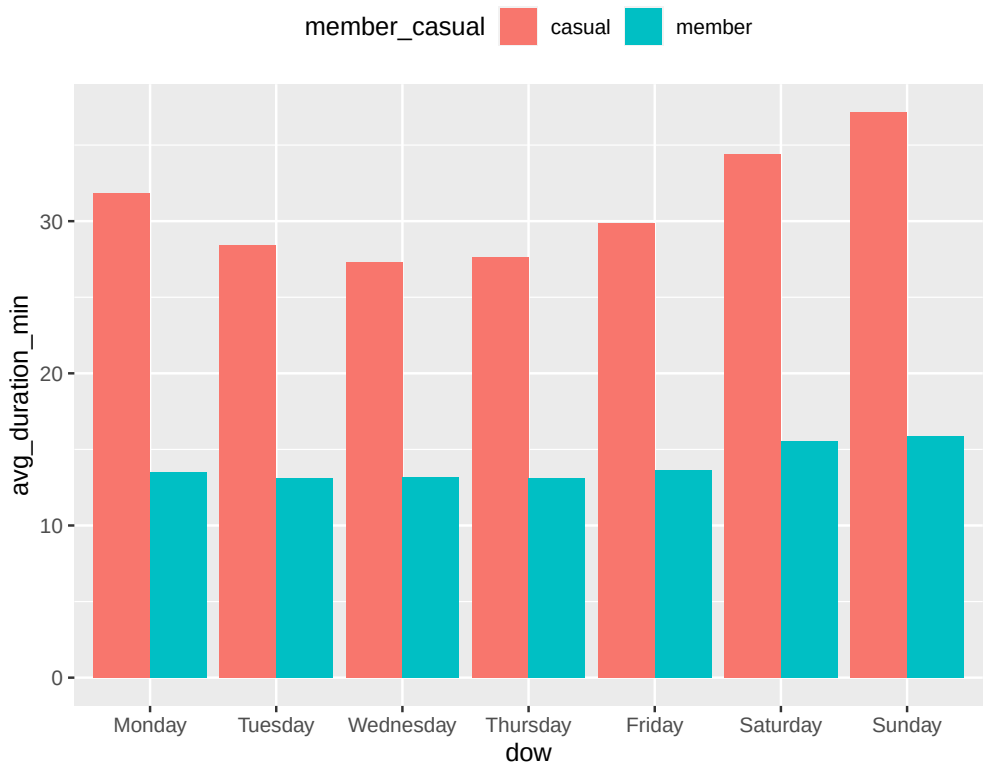
How do casual customers and members differ in # of rides & average ride duration (in minutes) by time of day?

```
## Use by $tod ($tod_char)
CyclisticData %>%
  group_by(member_casual, tod_char) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min))
```

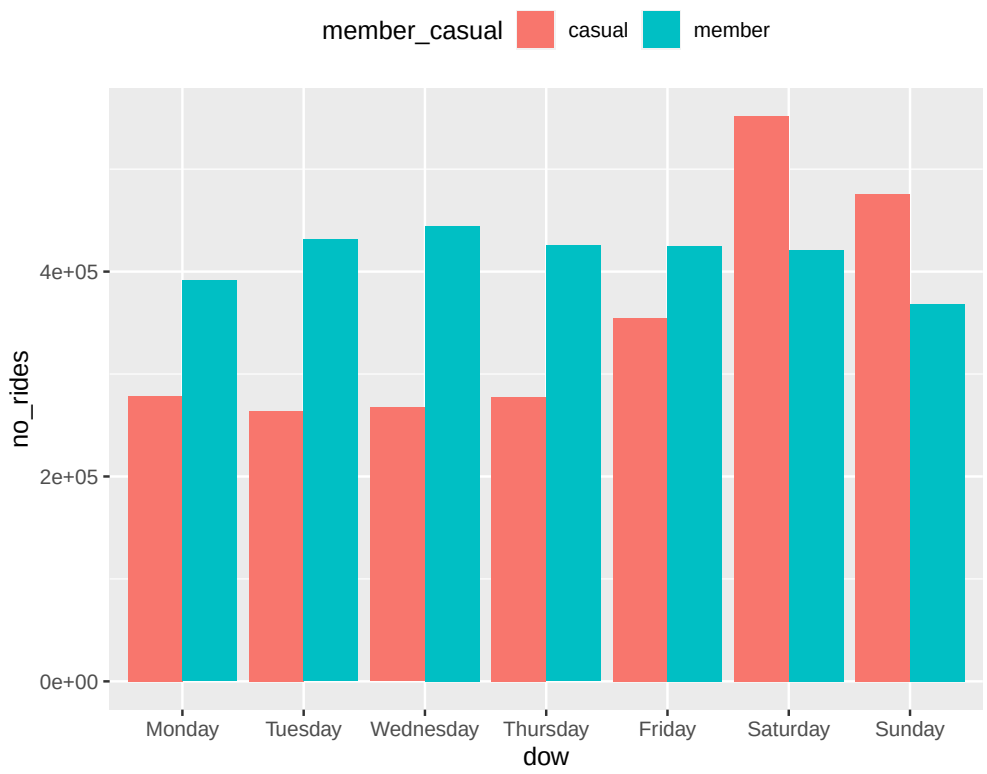
How do casual customers and members differ in # of rides & average ride duration (in minutes) by day of the week?

```
## Use by $dow
CyclisticData %>%
  group_by(member_casual, dow) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min))
```

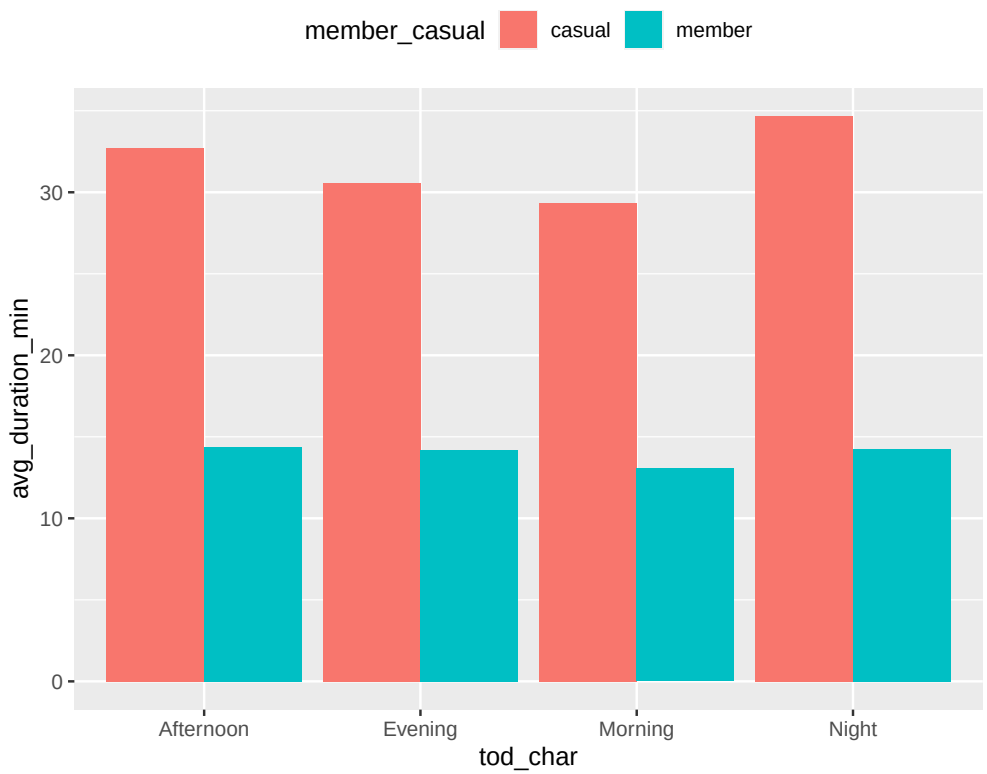
```
CyclisticData %>%
  group_by(member_casual, dow) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min)) %>%
  ggplot(mapping = aes(x = dow, y = avg_duration_min, fill = member_casual)) +
  geom_col(position="dodge") +
  theme(legend.position="top")
```



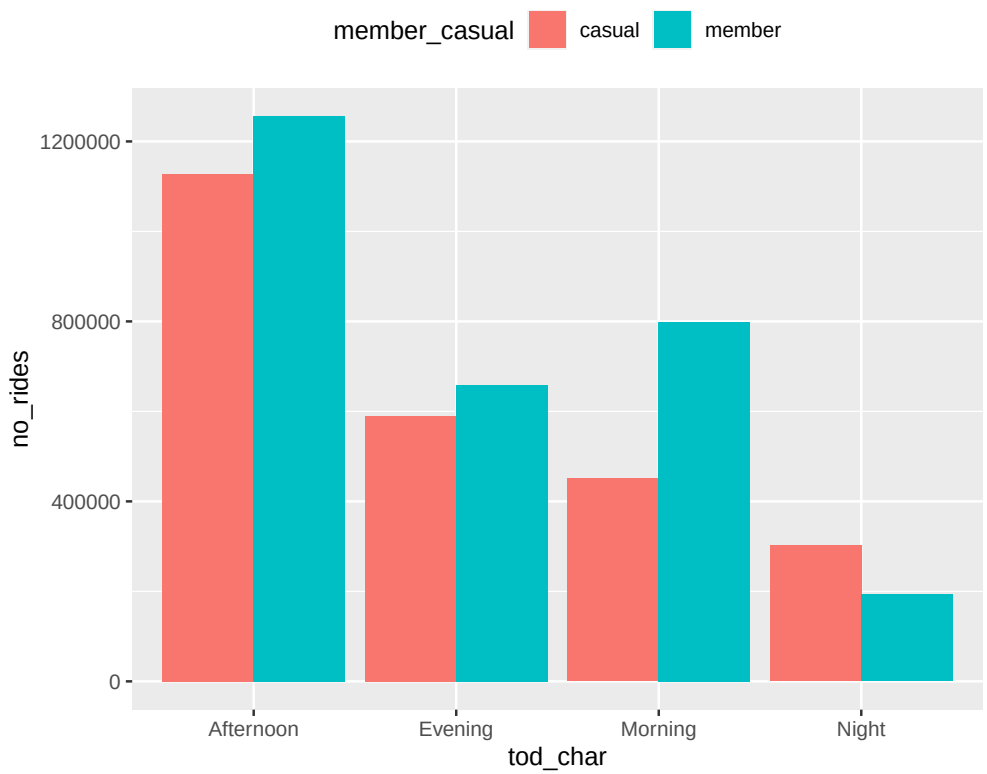

```
CyclisticData %>%
  group_by(member_casual, dow) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min)) %>%
  ggplot(mapping = aes(x = dow, y = no_rides, fill = member_casual)) +
  geom_col(position="dodge") +
  theme(legend.position="top")
```



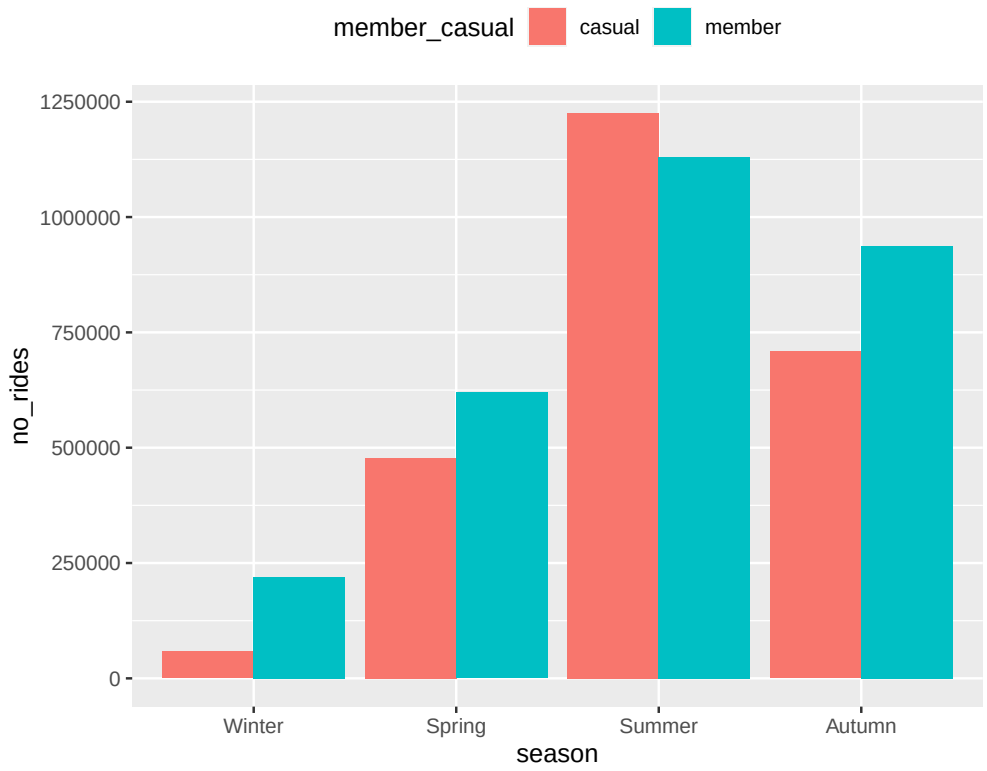

```
CyclisticData %>%
  group_by(member_casual, tod_char) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min)) %>%
  ggplot(mapping = aes(x = tod_char, y = avg_duration_min, fill = member_casual)) +
  geom_col(position="dodge") +
  theme(legend.position="top")
```




```
CyclisticData %>%
  group_by(member_casual, tod_char) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min)) %>%
  ggplot(mapping = aes(x = tod_char, y = no_rides, fill = member_casual)) +
  geom_col(position="dodge") +
  theme(legend.position="top")
```




```
CyclisticData %>%
  group_by(member_casual, season) %>%
  summarise(no_rides = n(),
            avg_duration_min = mean(ride_length_min)) %>%
  ggplot(mapping = aes(x = season, y = no_rides, fill = member_casual)) +
  geom_col(position="dodge") +
  theme(legend.position="top")
```


member_casual
casual
member
1250000
1000000
750000
500000
250000
0
no_rides
Winter
Spring
Summer
Autumn
season