Google Capstone Project

Topic : Cyclist Bike Sharing Analysis

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Business Task

Analyse rider's usage patterns for marketing membership conversion programs.

Case Study: Bike Sharing

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

```
## -- Attaching packages --------------------------------------- tidyverse
1.3.1 --
```

```
## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.2     v dplyr   1.0.7
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1
```

```
## -- Conflicts ------------------------------------------
tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x 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(skimr) #get summary data
library(janitor)
```

```
##
## Attaching package: 'janitor'
```

```
## The following objects are masked from 'package:stats':
##
##     chisq.test, fisher.test
```

```
library(dplyr)
```

STEP 1: COLLECT DATA

```
#=====================================================
```

```
Trips_Apr20 <- read_csv('202004-divvy-tripdata.csv')
```

```
##
## -- Column specification --------------------------------------------------
------
## 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()
## )

Trips_May20 <- read_csv('202005-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## 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()
## )

Trips_June20 <- read_csv('202006-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## 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()
## )

Trips_July20 <- read_csv('202007-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## 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()
## )

Trips_Aug20 <- read_csv('202008-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## 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()
## )

Trips_Sep20 <- read_csv('202009-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
```

```
------
## 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()
## )

Trips_Oct20 <- read_csv('202010-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## 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()
## )

Trips_Nov20 <- read_csv('202011-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## 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()
## )

Trips_Dec20 <- read_csv('202012-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## cols(
##   ride_id = col_character(),
##   rideable_type = col_character(),
##   started_at = col_datetime(format = ""),
##   ended_at = col_datetime(format = ""),
##   start_station_name = col_character(),
##   start_station_id = col_character(),
##   end_station_name = col_character(),
##   end_station_id = col_character(),
##   start_lat = col_double(),
##   start_lng = col_double(),
##   end_lat = col_double(),
##   end_lng = col_double(),
##   member_casual = col_character()
## )

Trips_Jan21 <- read_csv('202101-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## cols(
##   ride_id = col_character(),
##   rideable_type = col_character(),
##   started_at = col_datetime(format = ""),
##   ended_at = col_datetime(format = ""),
##   start_station_name = col_character(),
##   start_station_id = col_character(),
##   end_station_name = col_character(),
##   end_station_id = col_character(),
##   start_lat = col_double(),
##   start_lng = col_double(),
##   end_lat = col_double(),
##   end_lng = col_double(),
##   member_casual = col_character()
## )

Trips_Feb21 <- read_csv('202102-divvy-tripdata.csv')
```

```
##
## -- Column specification --------------------------------------------------
------
## cols(
##   ride_id = col_character(),
##   rideable_type = col_character(),
##   started_at = col_datetime(format = ""),
##   ended_at = col_datetime(format = ""),
##   start_station_name = col_character(),
##   start_station_id = col_character(),
##   end_station_name = col_character(),
##   end_station_id = col_character(),
##   start_lat = col_double(),
##   start_lng = col_double(),
##   end_lat = col_double(),
##   end_lng = col_double(),
##   member_casual = col_character()
## )

Trips_Mar21 <- read_csv('202103-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## cols(
##   ride_id = col_character(),
##   rideable_type = col_character(),
##   started_at = col_datetime(format = ""),
##   ended_at = col_datetime(format = ""),
##   start_station_name = col_character(),
##   start_station_id = col_character(),
##   end_station_name = col_character(),
##   end_station_id = col_character(),
##   start_lat = col_double(),
##   start_lng = col_double(),
##   end_lat = col_double(),
##   end_lng = col_double(),
##   member_casual = col_character()
## )

Trips_Apr21 <- read_csv('202004-divvy-tripdata.csv')

##
## -- Column specification --------------------------------------------------
------
## 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()
## )
```

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(Trips_Apr20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_May20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_June20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_July20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_Aug20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_Sep20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_Oct20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_Nov20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_Dec20)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_Jan21)
```

```
##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

```
colnames(Trips_Feb21)
```

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

```
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"

colnames(Trips_Mar21)

##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"

colnames(Trips_Apr21)

##  [1] "ride_id"            "rideable_type"      "started_at"
##  [4] "ended_at"           "start_station_name" "start_station_id"
##  [7] "end_station_name"   "end_station_id"     "start_lat"
## [10] "start_lng"          "end_lat"            "end_lng"
## [13] "member_casual"
```

Inspect the dataframes and look for inconguencies

```
#=====================================================
```

```
str(Trips_Apr20)

## spec_tbl_df [84,776 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:84776] "A847FADBBC638E45" "5405B80E996FF60D"
"5DD24A79A4E006F4" "2A59BBDF5CDBA725" ...
##  $ rideable_type     : chr [1:84776] "docked_bike" "docked_bike"
"docked_bike" "docked_bike" ...
##  $ started_at        : POSIXct[1:84776], format: "2020-04-26 17:45:14"
"2020-04-17 17:08:54" ...
##  $ ended_at          : POSIXct[1:84776], format: "2020-04-26 18:12:03"
"2020-04-17 17:17:03" ...
##  $ start_station_name: chr [1:84776] "Eckhart Park" "Drake Ave & Fullerton
Ave" "McClurg Ct & Erie St" "California Ave & Division St" ...
##  $ start_station_id  : num [1:84776] 86 503 142 216 125 173 35 434 627 377
...
##  $ end_station_name  : chr [1:84776] "Lincoln Ave & Diversey Pkwy"
"Kosciuszko Park" "Indiana Ave & Roosevelt Rd" "Wood St & Augusta Blvd" ...
##  $ end_station_id    : num [1:84776] 152 499 255 657 323 35 635 382 359
508 ...
##  $ start_lat         : num [1:84776] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:84776] -87.7 -87.7 -87.6 -87.7 -87.6 ...
##  $ end_lat           : num [1:84776] 41.9 41.9 41.9 41.9 42 ...
##  $ end_lng           : num [1:84776] -87.7 -87.7 -87.6 -87.7 -87.7 ...
##  $ member_casual     : chr [1:84776] "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()
##   .. )

str(Trips_May20)

## spec_tbl_df [200,274 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:200274] "02668AD35674B983"
"7A50CCAF1EDDB28F" "2FFCDFDB91FE9A52" "58991CF1DB75BA84" ...
##  $ rideable_type     : chr [1:200274] "docked_bike" "docked_bike"
"docked_bike" "docked_bike" ...
##  $ started_at        : POSIXct[1:200274], format: "2020-05-27 10:03:52"
"2020-05-25 10:47:11" ...
##  $ ended_at          : POSIXct[1:200274], format: "2020-05-27 10:16:49"
"2020-05-25 11:05:40" ...
##  $ start_station_name: chr [1:200274] "Franklin St & Jackson Blvd" "Clark
St & Wrightwood Ave" "Kedzie Ave & Milwaukee Ave" "Clarendon Ave & Leland
Ave" ...
##  $ start_station_id  : num [1:200274] 36 340 260 251 261 206 261 180 331
219 ...
##  $ end_station_name  : chr [1:200274] "Wabash Ave & Grand Ave" "Clark St &
Leland Ave" "Kedzie Ave & Milwaukee Ave" "Lake Shore Dr & Wellington Ave" ...
##  $ end_station_id    : num [1:200274] 199 326 260 157 206 22 261 180 300
305 ...
##  $ start_lat         : num [1:200274] 41.9 41.9 41.9 42 41.9 ...
##  $ start_lng         : num [1:200274] -87.6 -87.6 -87.7 -87.7 -87.7 ...
##  $ end_lat           : num [1:200274] 41.9 42 41.9 41.9 41.8 ...
##  $ end_lng           : num [1:200274] -87.6 -87.7 -87.7 -87.6 -87.6 ...
##  $ member_casual     : chr [1:200274] "member" "casual" "casual" "casual"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
```

```
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
```

```
str(Trips_June20)
```

```
## spec_tbl_df [343,005 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:343005] "8CD5DE2C2B6C4CFC"
"9A191EB2C751D85D" "F37D14B0B5659BCF" "C41237B506E85FA1" ...
##  $ rideable_type     : chr [1:343005] "docked_bike" "docked_bike"
"docked_bike" "docked_bike" ...
##  $ started_at        : POSIXct[1:343005], format: "2020-06-13 23:24:48"
"2020-06-26 07:26:10" ...
##  $ ended_at          : POSIXct[1:343005], format: "2020-06-13 23:36:55"
"2020-06-26 07:31:58" ...
##  $ start_station_name: chr [1:343005] "Wilton Ave & Belmont Ave" "Federal
St & Polk St" "Daley Center Plaza" "Broadway & Cornelia Ave" ...
##  $ start_station_id  : num [1:343005] 117 41 81 303 327 327 41 115 338 84
...
##  $ end_station_name  : chr [1:343005] "Damen Ave & Clybourn Ave" "Daley
Center Plaza" "State St & Harrison St" "Broadway & Berwyn Ave" ...
##  $ end_station_id    : num [1:343005] 163 81 5 294 117 117 81 303 164 53
...
##  $ start_lat         : num [1:343005] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:343005] -87.7 -87.6 -87.6 -87.6 -87.7 ...
##  $ end_lat           : num [1:343005] 41.9 41.9 41.9 42 41.9 ...
##  $ end_lng           : num [1:343005] -87.7 -87.6 -87.6 -87.7 -87.7 ...
##  $ member_casual     : chr [1:343005] "casual" "member" "member" "casual"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
```

```
str(Trips_July20)
```

```
## spec_tbl_df [551,480 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:551480] "762198876D69004D"
"BEC9C9FBA0D4CF1B" "D2FD8EA432C77EC1" "54AE594E20B35881" ...
##  $ rideable_type     : chr [1:551480] "docked_bike" "docked_bike"
"docked_bike" "docked_bike" ...
##  $ started_at        : POSIXct[1:551480], format: "2020-07-09 15:22:02"
"2020-07-24 23:56:30" ...
##  $ ended_at          : POSIXct[1:551480], format: "2020-07-09 15:25:52"
"2020-07-25 00:20:17" ...
##  $ start_station_name: chr [1:551480] "Ritchie Ct & Banks St" "Halsted St
& Roscoe St" "Lake Shore Dr & Diversey Pkwy" "LaSalle St & Illinois St" ...
##  $ start_station_id  : num [1:551480] 180 299 329 181 268 635 113 211 176
31 ...
##  $ end_station_name  : chr [1:551480] "Wells St & Evergreen Ave" "Broadway
& Ridge Ave" "Clark St & Wellington Ave" "Clark St & Armitage Ave" ...
##  $ end_station_id    : num [1:551480] 291 461 156 94 301 289 140 31 191
142 ...
##  $ start_lat         : num [1:551480] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:551480] -87.6 -87.6 -87.6 -87.6 -87.6 ...
##  $ end_lat           : num [1:551480] 41.9 42 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:551480] -87.6 -87.7 -87.6 -87.6 -87.6 ...
##  $ member_casual     : chr [1:551480] "member" "member" "casual" "casual"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
```

```
str(Trips_Aug20)
```

```
## spec_tbl_df [622,361 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:622361] "322BD23D287743ED"
"2A3AEF1AB9054D8B" "67DC1D133E8B5816" "C79FBBD412E578A7" ...
##  $ rideable_type     : chr [1:622361] "docked_bike" "electric_bike"
"electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:622361], format: "2020-08-20 18:08:14"
```

```
"2020-08-27 18:46:04" ...
##  $ ended_at          : POSIXct[1:622361], format: "2020-08-20 18:17:51"
"2020-08-27 19:54:51" ...
##  $ start_station_name: chr [1:622361] "Lake Shore Dr & Diversey Pkwy"
"Michigan Ave & 14th St" "Columbus Dr & Randolph St" "Daley Center Plaza" ...
##  $ start_station_id  : num [1:622361] 329 168 195 81 658 658 196 67 153
177 ...
##  $ end_station_name  : chr [1:622361] "Clark St & Lincoln Ave" "Michigan
Ave & 14th St" "State St & Randolph St" "State St & Kinzie St" ...
##  $ end_station_id    : num [1:622361] 141 168 44 47 658 658 49 229 225 305
...
##  $ start_lat         : num [1:622361] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:622361] -87.6 -87.6 -87.6 -87.6 -87.7 ...
##  $ end_lat           : num [1:622361] 41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:622361] -87.6 -87.6 -87.6 -87.6 -87.7 ...
##  $ member_casual     : chr [1:622361] "member" "casual" "casual" "casual"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
```

```
str(Trips_Sep20)
```

```
## spec_tbl_df [532,958 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:532958] "2B22BD5F95FB2629"
"A7FB70B4AFC6CAF2" "86057FA01BAC778E" "57F6DC9A153DB98C" ...
##  $ rideable_type     : chr [1:532958] "electric_bike" "electric_bike"
"electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:532958], format: "2020-09-17 14:27:11"
"2020-09-17 15:07:31" ...
##  $ ended_at          : POSIXct[1:532958], format: "2020-09-17 14:44:24"
"2020-09-17 15:07:45" ...
##  $ start_station_name: chr [1:532958] "Michigan Ave & Lake St" "W Oakdale
Ave & N Broadway" "W Oakdale Ave & N Broadway" "Ashland Ave & Belle Plaine
Ave" ...
##  $ start_station_id  : num [1:532958] 52 NA NA 246 24 94 291 NA NA NA ...
##  $ end_station_name  : chr [1:532958] "Green St & Randolph St" "W Oakdale
```

```
Ave & N Broadway" "W Oakdale Ave & N Broadway" "Montrose Harbor" ...
##  $ end_station_id    : num [1:532958] 112 NA NA 249 24 NA 256 NA NA NA ...
##  $ start_lat         : num [1:532958] 41.9 41.9 41.9 42 41.9 ...
##  $ start_lng         : num [1:532958] -87.6 -87.6 -87.6 -87.7 -87.6 ...
##  $ end_lat           : num [1:532958] 41.9 41.9 41.9 42 41.9 ...
##  $ end_lng           : num [1:532958] -87.6 -87.6 -87.6 -87.6 -87.6 ...
##  $ member_casual     : chr [1:532958] "casual" "casual" "casual" "casual"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )

str(Trips_Oct20)

## spec_tbl_df [388,653 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:388653] "ACB6B40CF5B9044C"
"DF450C72FD109C01" "B6396B54A15AC0DF" "44A4AEE261B9E854" ...
##  $ rideable_type     : chr [1:388653] "electric_bike" "electric_bike"
"electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:388653], format: "2020-10-31 19:39:43"
"2020-10-31 23:50:08" ...
##  $ ended_at          : POSIXct[1:388653], format: "2020-10-31 19:57:12"
"2020-11-01 00:04:16" ...
##  $ start_station_name: chr [1:388653] "Lakeview Ave & Fullerton Pkwy"
"Southport Ave & Waveland Ave" "Stony Island Ave & 67th St" "Clark St & Grace
St" ...
##  $ start_station_id  : num [1:388653] 313 227 102 165 190 359 313 125 NA
174 ...
##  $ end_station_name  : chr [1:388653] "Rush St & Hubbard St" "Kedzie Ave &
Milwaukee Ave" "University Ave & 57th St" "Broadway & Sheridan Rd" ...
##  $ end_station_id    : num [1:388653] 125 260 423 256 185 53 125 313 199
635 ...
##  $ start_lat         : num [1:388653] 41.9 41.9 41.8 42 41.9 ...
##  $ start_lng         : num [1:388653] -87.6 -87.7 -87.6 -87.7 -87.7 ...
##  $ end_lat           : num [1:388653] 41.9 41.9 41.8 42 41.9 ...
##  $ end_lng           : num [1:388653] -87.6 -87.7 -87.6 -87.7 -87.7 ...
##  $ member_casual     : chr [1:388653] "casual" "casual" "casual" "casual"
```

```
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
```

```
str(Trips_Nov20)
```

```
## spec_tbl_df [259,716 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:259716] "BD0A6FF6FFF9B921"
"96A7A7A4BDE4F82D" "C61526D06582BDC5" "E533E89C32080B9E" ...
##  $ rideable_type     : chr [1:259716] "electric_bike" "electric_bike"
"electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:259716], format: "2020-11-01 13:36:00"
"2020-11-01 10:03:26" ...
##  $ ended_at          : POSIXct[1:259716], format: "2020-11-01 13:45:40"
"2020-11-01 10:14:45" ...
##  $ start_station_name: chr [1:259716] "Dearborn St & Erie St" "Franklin St
& Illinois St" "Lake Shore Dr & Monroe St" "Leavitt St & Chicago Ave" ...
##  $ start_station_id  : num [1:259716] 110 672 76 659 2 72 76 NA 58 394 ...
##  $ end_station_name  : chr [1:259716] "St. Clair St & Erie St" "Noble St &
Milwaukee Ave" "Federal St & Polk St" "Stave St & Armitage Ave" ...
##  $ end_station_id    : num [1:259716] 211 29 41 185 2 76 72 NA 288 273 ...
##  $ start_lat         : num [1:259716] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:259716] -87.6 -87.6 -87.6 -87.7 -87.6 ...
##  $ end_lat           : num [1:259716] 41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:259716] -87.6 -87.7 -87.6 -87.7 -87.6 ...
##  $ member_casual     : chr [1:259716] "casual" "casual" "casual" "casual"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_double(),
##   ..   end_station_name = col_character(),
```

```
##   ..   end_station_id = col_double(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )

str(Trips_Dec20)

## spec_tbl_df [131,573 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:131573] "70B6A9A437D4C30D"
"158A465D4E74C54A" "5262016E0F1F2F9A" "BE119628E44F871E" ...
##  $ rideable_type     : chr [1:131573] "classic_bike" "electric_bike"
"electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:131573], format: "2020-12-27 12:44:29"
"2020-12-18 17:37:15" ...
##  $ ended_at          : POSIXct[1:131573], format: "2020-12-27 12:55:06"
"2020-12-18 17:44:19" ...
##  $ start_station_name: chr [1:131573] "Aberdeen St & Jackson Blvd" NA NA
NA ...
##  $ start_station_id  : chr [1:131573] "13157" NA NA NA ...
##  $ end_station_name  : chr [1:131573] "Desplaines St & Kinzie St" NA NA NA
...
##  $ end_station_id    : chr [1:131573] "TA1306000003" NA NA NA ...
##  $ start_lat         : num [1:131573] 41.9 41.9 41.9 41.9 41.8 ...
##  $ start_lng         : num [1:131573] -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ end_lat           : num [1:131573] 41.9 41.9 41.9 41.9 41.8 ...
##  $ end_lng           : num [1:131573] -87.6 -87.7 -87.7 -87.7 -87.6 ...
##  $ member_casual     : chr [1:131573] "member" "member" "member" "member"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )

str(Trips_Jan21)
```

```
## spec_tbl_df [96,834 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:96834] "E19E6F1B8D4C42ED" "DC88F20C2C55F27F"
"EC45C94683FE3F27" "4FA453A75AE377DB" ...
##  $ rideable_type     : chr [1:96834] "electric_bike" "electric_bike"
"electric_bike" "electric_bike" ...
##  $ started_at        : POSIXct[1:96834], format: "2021-01-23 16:14:19"
"2021-01-27 18:43:08" ...
##  $ ended_at          : POSIXct[1:96834], format: "2021-01-23 16:24:44"
"2021-01-27 18:47:12" ...
##  $ start_station_name: chr [1:96834] "California Ave & Cortez St"
"California Ave & Cortez St" "California Ave & Cortez St" "California Ave &
Cortez St" ...
##  $ start_station_id  : chr [1:96834] "17660" "17660" "17660" "17660" ...
##  $ end_station_name  : chr [1:96834] NA NA NA NA ...
##  $ end_station_id    : chr [1:96834] NA NA NA NA ...
##  $ start_lat         : num [1:96834] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:96834] -87.7 -87.7 -87.7 -87.7 -87.7 ...
##  $ end_lat           : num [1:96834] 41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num [1:96834] -87.7 -87.7 -87.7 -87.7 -87.7 ...
##  $ member_casual     : chr [1:96834] "member" "member" "member" "member"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
```

```
str(Trips_Feb21)
```

```
## spec_tbl_df [49,622 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:49622] "89E7AA6C29227EFF" "0FEFDE2603568365"
"E6159D746B2DBB91" "B32D3199F1C2E75B" ...
##  $ rideable_type     : chr [1:49622] "classic_bike" "classic_bike"
"electric_bike" "classic_bike" ...
##  $ started_at        : POSIXct[1:49622], format: "2021-02-12 16:14:56"
"2021-02-14 17:52:38" ...
##  $ ended_at          : POSIXct[1:49622], format: "2021-02-12 16:21:43"
"2021-02-14 18:12:09" ...
##  $ start_station_name: chr [1:49622] "Glenwood Ave & Touhy Ave" "Glenwood
```

```
Ave & Touhy Ave" "Clark St & Lake St" "Wood St & Chicago Ave" ...
##  $ start_station_id  : chr [1:49622] "525" "525" "KA1503000012" "637" ...
##  $ end_station_name  : chr [1:49622] "Sheridan Rd & Columbia Ave"
"Bosworth Ave & Howard St" "State St & Randolph St" "Honore St & Division St"
...
##  $ end_station_id    : chr [1:49622] "660" "16806" "TA1305000029"
"TA1305000034" ...
##  $ start_lat         : num [1:49622] 42 42 41.9 41.9 41.8 ...
##  $ start_lng         : num [1:49622] -87.7 -87.7 -87.6 -87.7 -87.6 ...
##  $ end_lat           : num [1:49622] 42 42 41.9 41.9 41.8 ...
##  $ end_lng           : num [1:49622] -87.7 -87.7 -87.6 -87.7 -87.6 ...
##  $ member_casual     : chr [1:49622] "member" "casual" "member" "member"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
```

```
str(Trips_Mar21)
```

```
## spec_tbl_df [228,496 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:228496] "CFA86D4455AA1030"
"30D9DC61227D1AF3" "846D87A15682A284" "994D05AA75A168F2" ...
##  $ rideable_type     : chr [1:228496] "classic_bike" "classic_bike"
"classic_bike" "classic_bike" ...
##  $ started_at        : POSIXct[1:228496], format: "2021-03-16 08:32:30"
"2021-03-28 01:26:28" ...
##  $ ended_at          : POSIXct[1:228496], format: "2021-03-16 08:36:34"
"2021-03-28 01:36:55" ...
##  $ start_station_name: chr [1:228496] "Humboldt Blvd & Armitage Ave"
"Humboldt Blvd & Armitage Ave" "Shields Ave & 28th Pl" "Winthrop Ave &
Lawrence Ave" ...
##  $ start_station_id  : chr [1:228496] "15651" "15651" "15443"
"TA1308000021" ...
##  $ end_station_name  : chr [1:228496] "Stave St & Armitage Ave" "Central
Park Ave & Bloomingdale Ave" "Halsted St & 35th St" "Broadway & Sheridan Rd"
...
##  $ end_station_id    : chr [1:228496] "13266" "18017" "TA1308000043"
```

```
"13323" ...
##  $ start_lat         : num [1:228496] 41.9 41.9 41.8 42 42 ...
##  $ start_lng         : num [1:228496] -87.7 -87.7 -87.6 -87.7 -87.7 ...
##  $ end_lat           : num [1:228496] 41.9 41.9 41.8 42 42.1 ...
##  $ end_lng           : num [1:228496] -87.7 -87.7 -87.6 -87.6 -87.7 ...
##  $ member_casual     : chr [1:228496] "casual" "casual" "casual" "casual"
...
##  - attr(*, "spec")=
##   .. cols(
##   ..   ride_id = col_character(),
##   ..   rideable_type = col_character(),
##   ..   started_at = col_datetime(format = ""),
##   ..   ended_at = col_datetime(format = ""),
##   ..   start_station_name = col_character(),
##   ..   start_station_id = col_character(),
##   ..   end_station_name = col_character(),
##   ..   end_station_id = col_character(),
##   ..   start_lat = col_double(),
##   ..   start_lng = col_double(),
##   ..   end_lat = col_double(),
##   ..   end_lng = col_double(),
##   ..   member_casual = col_character()
##   .. )
```

```
str(Trips_Apr21)
```

```
## spec_tbl_df [84,776 x 13] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ ride_id           : chr [1:84776] "A847FADBBC638E45" "5405B80E996FF60D"
"5DD24A79A4E006F4" "2A59BBDF5CDBA725" ...
##  $ rideable_type     : chr [1:84776] "docked_bike" "docked_bike"
"docked_bike" "docked_bike" ...
##  $ started_at        : POSIXct[1:84776], format: "2020-04-26 17:45:14"
"2020-04-17 17:08:54" ...
##  $ ended_at          : POSIXct[1:84776], format: "2020-04-26 18:12:03"
"2020-04-17 17:17:03" ...
##  $ start_station_name: chr [1:84776] "Eckhart Park" "Drake Ave & Fullerton
Ave" "McClurg Ct & Erie St" "California Ave & Division St" ...
##  $ start_station_id  : num [1:84776] 86 503 142 216 125 173 35 434 627 377
...
##  $ end_station_name  : chr [1:84776] "Lincoln Ave & Diversey Pkwy"
"Kosciuszko Park" "Indiana Ave & Roosevelt Rd" "Wood St & Augusta Blvd" ...
##  $ end_station_id    : num [1:84776] 152 499 255 657 323 35 635 382 359
508 ...
##  $ start_lat         : num [1:84776] 41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num [1:84776] -87.7 -87.7 -87.6 -87.7 -87.6 ...
##  $ end_lat           : num [1:84776] 41.9 41.9 41.9 41.9 42 ...
##  $ end_lng           : num [1:84776] -87.7 -87.7 -87.6 -87.7 -87.7 ...
##  $ member_casual     : chr [1:84776] "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()
##   .. )
```

we can compare column datatype across all dataframe by using compare_df_cols when we have large dataset, that would be more easy

```
compare_df_cols(Trips_Apr20, Trips_May20, Trips_June20, Trips_July20,
Trips_Aug20, Trips_Sep20, Trips_Oct20, Trips_Nov20, Trips_Dec20,
Trips_Jan21, Trips_Feb21, Trips_Mar21, Trips_Apr21, return = "mismatch")
```

```
##        column_name Trips_Apr20 Trips_May20 Trips_June20 Trips_July20
## 1   end_station_id     numeric     numeric      numeric      numeric
## 2 start_station_id     numeric     numeric      numeric      numeric
##   Trips_Aug20 Trips_Sep20 Trips_Oct20 Trips_Nov20 Trips_Dec20 Trips_Jan21
## 1     numeric     numeric     numeric     numeric   character   character
## 2     numeric     numeric     numeric     numeric   character   character
##   Trips_Feb21 Trips_Mar21 Trips_Apr21
## 1   character   character     numeric
## 2   character   character     numeric
```

Convert end_station_id and start_station_id to character so that they can stack correctly

```
Trips_Apr20 <- mutate(Trips_Apr20, end_station_id =
as.character(end_station_id), start_station_id =
as.character(start_station_id))
Trips_May20 <- mutate(Trips_May20, end_station_id =
as.character(end_station_id), start_station_id =
as.character(start_station_id))
Trips_June20 <- mutate(Trips_June20, end_station_id =
as.character(end_station_id), start_station_id =
as.character(start_station_id))
Trips_July20 <- mutate(Trips_July20, end_station_id =
as.character(end_station_id), start_station_id =
```

```
as.character(start_station_id))
Trips_Aug20 <- mutate(Trips_Aug20, end_station_id =
as.character(end_station_id), start_station_id =
as.character(start_station_id))
Trips_Sep20 <- mutate(Trips_Sep20, end_station_id =
as.character(end_station_id), start_station_id =
as.character(start_station_id))
Trips_Oct20 <- mutate(Trips_Oct20, end_station_id =
as.character(end_station_id), start_station_id =
as.character(start_station_id))
Trips_Nov20 <- mutate(Trips_Nov20, end_station_id =
as.character(end_station_id), start_station_id =
as.character(start_station_id))
Trips_Apr21 <- mutate(Trips_Apr21, end_station_id =
as.character(end_station_id), start_station_id =
as.character(start_station_id))
```

double check column datatype across all dataframe

```
compare_df_cols(Trips_Apr20, Trips_May20, Trips_June20, Trips_July20,
Trips_Aug20, Trips_Sep20, Trips_Oct20, Trips_Nov20, Trips_Dec20,
Trips_Jan21, Trips_Feb21, Trips_Mar21, Trips_Apr21, return = "mismatch")
```

```
##  [1] column_name  Trips_Apr20  Trips_May20  Trips_June20 Trips_July20
##  [6] Trips_Aug20  Trips_Sep20  Trips_Oct20  Trips_Nov20  Trips_Dec20
## [11] Trips_Jan21  Trips_Feb21  Trips_Mar21  Trips_Apr21
## <0 rows> (or 0-length row.names)
```

Stack individual data frames into one big data frame

```
all_trips <- bind_rows(Trips_Apr20, Trips_May20, Trips_June20, Trips_July20,
Trips_Aug20, Trips_Sep20, Trips_Oct20, Trips_Nov20, Trips_Dec20,
Trips_Jan21, Trips_Feb21, Trips_Mar21, Trips_Apr21)
```

Remove unused column

```
all_trips <- all_trips %>%
  select(-c(start_lat, start_lng, end_lat, end_lng))
```

Rename Columns

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

STEP 3: CLEAN UP AND ADD DATA TO PREPARE FOR ANALYSIS

#==========# Inspect the new table that has been created

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

## [1] "trip_id"           "ride_type"         "start_time"
## [4] "end_time"          "from_station_name" "from_station_id"
## [7] "to_station_name"   "to_station_id"     "usertype"

dim(all_trips)  #Dimensions of the data frame?

## [1] 3574524       9

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

## # A tibble: 6 x 9
##   trip_id   ride_type start_time          end_time
from_station_name
##   <chr>     <chr>     <dttm>              <dttm>              <chr>
## 1 A847FADB~ docked_b~ 2020-04-26 17:45:14 2020-04-26 18:12:03 Eckhart Park
## 2 5405B80E~ docked_b~ 2020-04-17 17:08:54 2020-04-17 17:17:03 Drake Ave &
Fulle~
## 3 5DD24A79~ docked_b~ 2020-04-01 17:54:13 2020-04-01 18:08:36 McClurg Ct &
Erie~
## 4 2A59BBDF~ docked_b~ 2020-04-07 12:50:19 2020-04-07 13:02:31 California
Ave & ~
## 5 27AD306C~ docked_b~ 2020-04-18 10:22:59 2020-04-18 11:15:54 Rush St &
Hubbard~
## 6 356216E8~ docked_b~ 2020-04-30 17:55:47 2020-04-30 18:01:11 Mies van der
Rohe~
## # ... with 4 more variables: from_station_id <chr>, to_station_name <chr>,
## #   to_station_id <chr>, usertype <chr>

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

## tibble [3,574,524 x 9] (S3: tbl_df/tbl/data.frame)
##  $ trip_id          : chr [1:3574524] "A847FADBBC638E45"
"5405B80E996FF60D" "5DD24A79A4E006F4" "2A59BBDF5CDBA725" ...
##  $ ride_type        : chr [1:3574524] "docked_bike" "docked_bike"
"docked_bike" "docked_bike" ...
##  $ start_time       : POSIXct[1:3574524], format: "2020-04-26 17:45:14"
"2020-04-17 17:08:54" ...
##  $ end_time         : POSIXct[1:3574524], format: "2020-04-26 18:12:03"
"2020-04-17 17:17:03" ...
##  $ from_station_name: chr [1:3574524] "Eckhart Park" "Drake Ave &
Fullerton Ave" "McClurg Ct & Erie St" "California Ave & Division St" ...
##  $ from_station_id  : chr [1:3574524] "86" "503" "142" "216" ...
##  $ to_station_name  : chr [1:3574524] "Lincoln Ave & Diversey Pkwy"
"Kosciuszko Park" "Indiana Ave & Roosevelt Rd" "Wood St & Augusta Blvd" ...
```

```
##  $ to_station_id    : chr [1:3574524] "152" "499" "255" "657" ...
##  $ usertype         : chr [1:3574524] "member" "member" "member" "member"
...

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

##    trip_id            ride_type           start_time
##  Length:3574524     Length:3574524     Min.   :2020-04-01 00:00:30
##  Class :character   Class :character   1st Qu.:2020-07-11 15:53:56
##  Mode  :character   Mode  :character   Median :2020-08-27 15:44:17
##                                        Mean   :2020-09-06 13:37:36
##                                        3rd Qu.:2020-10-17 22:11:16
##                                        Max.   :2021-03-31 23:59:08
##     end_time                    from_station_name  from_station_id
##  Min.   :2020-04-01 00:10:45   Length:3574524     Length:3574524
##  1st Qu.:2020-07-11 16:27:48   Class :character   Class :character
##  Median :2020-08-27 16:07:07   Mode  :character   Mode  :character
##  Mean   :2020-09-06 14:02:38
##  3rd Qu.:2020-10-17 22:36:28
##  Max.   :2021-04-06 11:00:11
##  to_station_name    to_station_id        usertype
##  Length:3574524     Length:3574524     Length:3574524
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##

skim(all_trips) #get summary of data, check missing data
```

Data summary

Name	all_trips
Number of rows	3574524
Number of columns	9

_____

Column type frequency:

character	7
POSIXct	2

_____

Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace

trip_id	0	1.00	16	16	0	3489539	0
ride_type	0	1.00	11	13	0	3	0
from_station_name	122175	0.97	10	53	0	708	0
from_station_id	122801	0.97	1	35	0	1259	0
to_station_name	143341	0.96	10	53	0	706	0
to_station_id	143802	0.96	1	35	0	1259	0
usertype	0	1.00	6	6	0	2	0

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
start_time	0	1	2020-04-01 00:00:30	2021-03-31 23:59:08	2020-08-27 15:44:17	3040228
end_time	0	1	2020-04-01 00:10:45	2021-04-06 11:00:11	2020-08-27 16:07:07	3027775

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$date <- as.Date(all_trips$start_time) #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)

```
all_trips$ride_length <- difftime(all_trips$end_time,all_trips$start_time)
```

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

```
skim(all_trips$ride_length)
```

Data summary

Name	all_trips$ride_length
Number of rows	3574524
Number of columns	1

_____

Column type frequency:

numeric	1

_____

Group variables	None

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
data	0	1	1501.77	23732.69	-1742998	474	873	1600	3523202	▁▇▁▁▁

```
all_trips_v2 <- all_trips[!(all_trips$ride_length<0),]
skim(all_trips_v2)
```

Data summary

Name	all_trips_v2
Number of rows	3563921
Number of columns	15

_____

Column type frequency:

character	11
Date	1
numeric	1
POSIXct	2

Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
trip_id	0	1.00	16	16	0	3479196	0
ride_type	0	1.00	11	13	0	3	0
from_station_name	122128	0.97	10	53	0	708	0
from_station_id	122754	0.97	1	35	0	1259	0
to_station_name	143257	0.96	10	53	0	706	0
to_station_id	143718	0.96	1	35	0	1259	0
usertype	0	1.00	6	6	0	2	0
month	0	1.00	2	2	0	12	0
day	0	1.00	2	2	0	31	0
year	0	1.00	4	4	0	2	0
day_of_week	0	1.00	6	9	0	7	0

Variable type: Date

skim_variable	n_missing	complete_rate	min	max	median	n_unique
date	0	1	2020-04-01	2021-03-31	2020-08-27	363

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
ride_length	0	1	1688.35	15883.15	0	477	876	1603	3523202	▇▁▁▁▁

Variable type: POSIXct

skim_variable	n_missing	complete_rate	min	max	median	n_unique
start_time	0	1	2020-04-01 00:00:30	2021-03-31 23:59:08	2020-08-27 14:56:13	3035417
end_time	0	1	2020-04-01 00:10:45	2021-04-06 11:00:11	2020-08-27 15:21:31	3020300

STEP 4: CONDUCT DESCRIPTIVE ANALYSIS

#==========# Descriptive analysis on ride_length (all figures in seconds)

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

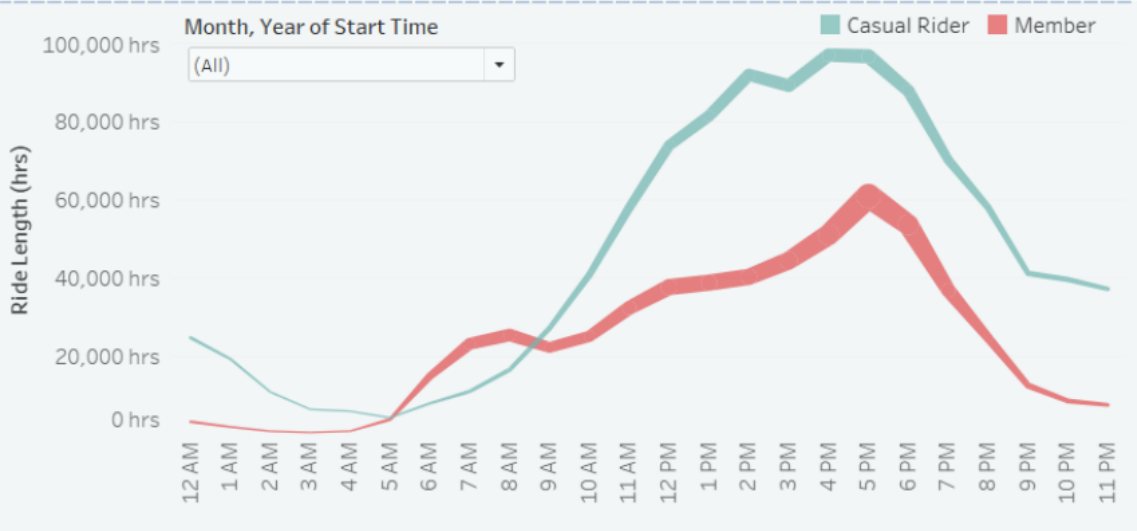
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##       0     477     876    1688    1603 3523202
```

Export to CSV file for further analysis

```
write.csv(all_trips_v2, "data.csv")
```

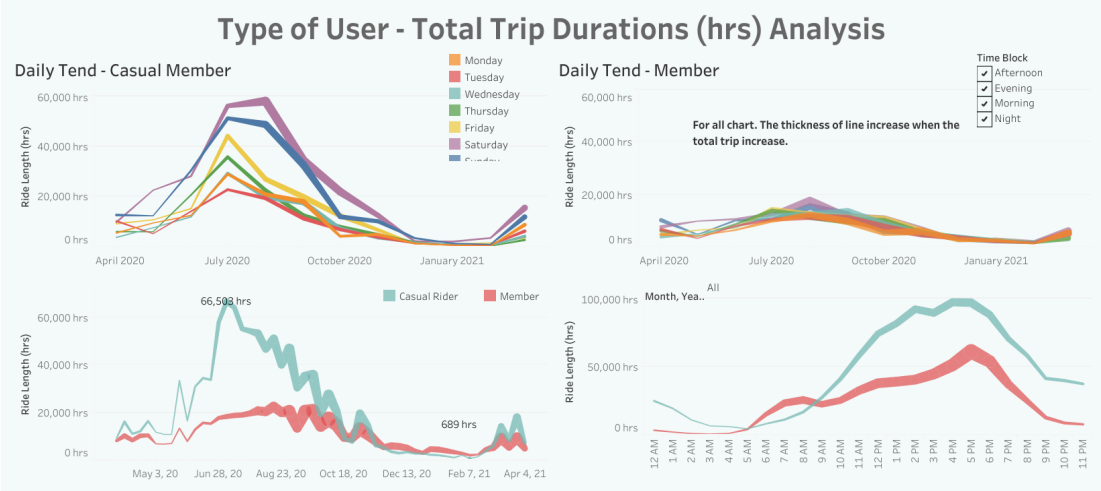
Conclusions :

The total trip duration for casual riders and annual members are affected by the season. The temperature is very low during the winter season, fewer people are willing to go out and people who need to travel daily for work will choose to take other public transport, this has caused the total trip duration to be the lowest among other seasons.



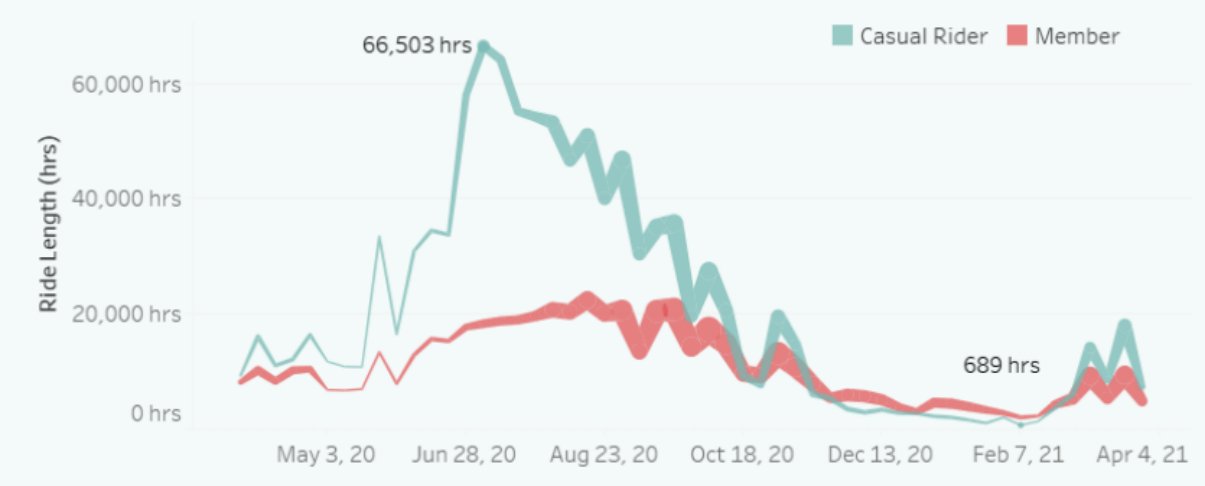
Over the years, we see a significant divergence of total trip duration from May to September for two groups of users. This has shown their usage pattern significantly due to their preference and it is more clear when we look into total trip duration on every single hour within the day.

The annual members display two peak periods which are at 7 a.m and 5 p.m indicating they are most likely office workers. The casual rider peak period is 4 p.m and 5 p.m. The top 20 stations visited by casual riders mostly are tourist locations, the casual riders most likely are a couple, students, retirees, tourists, or family.



Top 20 Station visit by Casual Rider

From Station Name	Rank	Ride Length
Millennium Park	1	25,072 hrs
Streeter Dr & Grand Ave	2	23,391 hrs
Lake Shore Dr & Monroe St	3	19,497 hrs
Indiana Ave & Roosevelt Rd	4	13,552 hrs
Michigan Ave & Washington St	5	13,076 hrs
Buckingham Fountain	6	12,932 hrs
Michigan Ave & Lake St	7	12,899 hrs
Michigan Ave & Oak St	8	12,266 hrs
Wabash Ave & Grand Ave	9	11,903 hrs
Lake Shore Dr & North Blvd	10	10,545 hrs
Theater on the Lake	15	9,652 hrs
Michigan Ave & 8th St	11	10,141 hrs
State St & Randolph St	12	10,074 hrs
Wabash Ave & Roosevelt Rd	13	9,896 hrs
Fairbanks Ct & Grand Ave	14	9,759 hrs
Columbus Dr & Randolph St	16	8,616 hrs
Wabash Ave & Wacker Pl	17	7,924 hrs
State St & Kinzie St	18	7,767 hrs
Clark St & Lincoln Ave	19	7,413 hrs
Shore Dr & 55th St	20	7,233 hrs



Based on the casual rider's monthly total trips durations, the best odds to launch the new marketing campaign is between April to May. Also, consider different price strategies like seasonal passes to increase the conversion rate.
The best would be if the marketing team can run a survey to collect the data from current casual riders, and understand what kind of features or benefits they look for when considering subscribing annual members.

For an interactive Tableau Dashboard, click here.