Divvy Capstone

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Set Up Environment

Load packages in R to enable cleaning and data transformation

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.2     v readr     2.1.4
## v forcats   1.0.0     v stringr   1.5.0
## v ggplot2   3.4.2     v tibble    3.2.1
## v lubridate 1.9.2     v tidyr     1.3.0
## v purrr     1.0.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(lubridate)
library(ggplot2)
getwd()
```

```
## [1] "C:/Users/toled/OneDrive/Desktop/R"
```

Upload data files as CSV

```
jan <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202201-divvy-tripdata.csv")
feb <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202202-divvy-tripdata.csv")
mar <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202203-divvy-tripdata.csv")
apr <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202204-divvy-tripdata.csv")
may <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202205-divvy-tripdata.csv")
jun <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202206-divvy-tripdata.csv")
jul <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202207-divvy-tripdata.csv")
aug <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202208-divvy-tripdata.csv")
sep <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202209-divvy-publictripdata.csv")
oct <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202210-divvy-tripdata.csv")
nov <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202211-divvy-tripdata.csv")
dec <- read.csv("C:/Users/toled/OneDrive/Desktop/Case Study 1/2022 CSV/202212-divvy-tripdata.csv")
```

Inspect data columns before combining into single dataframe

```
colnames(jan)
```

```
##  [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(feb)
```

```
##  [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(mar)
```

```
##  [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(apr)
```

```
##  [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(may)
```

```
##  [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(jun)
```

```
##  [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"
```

```r
colnames(jul)
```

```
##  [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"
```

```r
colnames(aug)
```

```
##  [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"
```

```r
colnames(sep)
```

```
##  [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"
```

```r
colnames(oct)
```

```
##  [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"
```

```r
colnames(nov)
```

```
##  [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"
```

```r
colnames(dec)
```

```
##  [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 dataframes to make sure strucure is the same before combining

```r
str(jan)
```

```
## 'data.frame':    103770 obs. of  13 variables:
##  $ ride_id           : chr  "C2F7DD78E82EC875" "A6CF8980A652D272" "BD0F91DFF741C66D" "CBB80ED4191054
##  $ rideable_type     : chr  "electric_bike" "electric_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-01-13 11:59:47" "2022-01-10 08:41:56" "2022-01-25 04:53:40" "2022-
##  $ ended_at          : chr  "2022-01-13 12:02:44" "2022-01-10 08:46:17" "2022-01-25 04:58:01" "2022-
##  $ start_station_name: chr  "Glenwood Ave & Touhy Ave" "Glenwood Ave & Touhy Ave" "Sheffield Ave & Fu
##  $ start_station_id  : chr  "525" "525" "TA1306000016" "KA1504000151" ...
##  $ end_station_name  : chr  "Clark St & Touhy Ave" "Clark St & Touhy Ave" "Greenview Ave & Fullerton
##  $ end_station_id    : chr  "RP-007" "RP-007" "TA1307000001" "TA1309000021" ...
##  $ start_lat         : num  42 42 41.9 42 41.9 ...
##  $ start_lng         : num  -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ end_lat           : num  42 42 41.9 42 41.9 ...
##  $ end_lng           : num  -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ member_casual     : chr  "casual" "casual" "member" "casual" ...
```

```r
str(feb)
```

```
## 'data.frame':    115609 obs. of  13 variables:
##  $ ride_id           : chr  "E1E065E7ED285C02" "1602DCDC5B30FFE3" "BE7DD2AF4B55C4AF" "A1789BDF844412
##  $ rideable_type     : chr  "classic_bike" "classic_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-02-19 18:08:41" "2022-02-20 17:41:30" "2022-02-25 18:55:56" "2022-
##  $ ended_at          : chr  "2022-02-19 18:23:56" "2022-02-20 17:45:56" "2022-02-25 19:09:34" "2022-
##  $ start_station_name: chr  "State St & Randolph St" "Halsted St & Wrightwood Ave" "State St & Randol
##  $ start_station_id  : chr  "TA1305000029" "TA1309000061" "TA1305000029" "13235" ...
##  $ end_station_name  : chr  "Clark St & Lincoln Ave" "Southport Ave & Wrightwood Ave" "Canal St & Ada
##  $ end_station_id    : chr  "13179" "TA1307000113" "13011" "13323" ...
##  $ start_lat         : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num  -87.6 -87.6 -87.6 -87.7 -87.6 ...
##  $ end_lat           : num  41.9 41.9 41.9 42 41.9 ...
##  $ end_lng           : num  -87.6 -87.7 -87.6 -87.6 -87.6 ...
##  $ member_casual     : chr  "member" "member" "member" "member" ...
```

```r
str(mar)
```

```
## 'data.frame':    284042 obs. of  13 variables:
##  $ ride_id           : chr  "47EC0A7F82E65D52" "8494861979B0F477" "EFE527AF80B66109" "9F446FD9DEE3F38
##  $ rideable_type     : chr  "classic_bike" "electric_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-03-21 13:45:01" "2022-03-16 09:37:16" "2022-03-23 19:52:02" "2022-
##  $ ended_at          : chr  "2022-03-21 13:51:18" "2022-03-16 09:43:34" "2022-03-23 19:54:48" "2022-
##  $ start_station_name: chr  "Wabash Ave & Wacker Pl" "Michigan Ave & Oak St" "Broadway & Berwyn Ave"
##  $ start_station_id  : chr  "TA1307000131" "13042" "13109" "TA1307000131" ...
##  $ end_station_name  : chr  "Kingsbury St & Kinzie St" "Orleans St & Chestnut St (NEXT Apts)" "Broadw
##  $ end_station_id    : chr  "KA1503000043" "620" "15578" "TA1305000025" ...
##  $ start_lat         : num  41.9 41.9 42 41.9 41.9 ...
##  $ start_lng         : num  -87.6 -87.6 -87.7 -87.6 -87.6 ...
##  $ end_lat           : num  41.9 41.9 42 41.9 41.9 ...
##  $ end_lng           : num  -87.6 -87.6 -87.7 -87.6 -87.7 ...
##  $ member_casual     : chr  "member" "member" "member" "member" ...
```

```r
str(apr)
```

```
## 'data.frame':    371249 obs. of  13 variables:
##  $ ride_id           : chr  "3564070EEFD12711" "0B820C7FCF22F489" "89EEEE32293F07FF" "84D4751AEB3188
##  $ rideable_type     : chr  "electric_bike" "classic_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-04-06 17:42:48" "2022-04-24 19:23:07" "2022-04-20 19:29:08" "2022-
##  $ ended_at          : chr  "2022-04-06 17:54:36" "2022-04-24 19:43:17" "2022-04-20 19:35:16" "2022-
##  $ start_station_name: chr  "Paulina St & Howard St" "Wentworth Ave & Cermak Rd" "Halsted St & Polk S
##  $ start_station_id  : chr  "515" "13075" "TA1307000121" "13075" ...
##  $ end_station_name  : chr  "University Library (NU)" "Green St & Madison St" "Green St & Madison St
##  $ end_station_id    : chr  "605" "TA1307000120" "TA1307000120" "KA1706005007" ...
##  $ start_lat         : num  42 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num  -87.7 -87.6 -87.6 -87.6 -87.6 ...
##  $ end_lat           : num  42.1 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num  -87.7 -87.6 -87.6 -87.6 -87.6 ...
##  $ member_casual     : chr  "member" "member" "member" "casual" ...
```

```r
str(may)
```

```
## 'data.frame':    634858 obs. of  13 variables:
##  $ ride_id           : chr  "EC2DE40644C6B0F4" "1C31AD03897EE385" "1542FBEC830415CF" "6FF59852924528
##  $ rideable_type     : chr  "classic_bike" "classic_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-05-23 23:06:58" "2022-05-11 08:53:28" "2022-05-26 18:36:28" "2022-
##  $ ended_at          : chr  "2022-05-23 23:40:19" "2022-05-11 09:31:22" "2022-05-26 18:58:18" "2022-
##  $ start_station_name: chr  "Wabash Ave & Grand Ave" "DuSable Lake Shore Dr & Monroe St" "Clinton St
##  $ start_station_id  : chr  "TA1307000117" "13300" "TA1305000032" "TA1305000032" ...
##  $ end_station_name  : chr  "Halsted St & Roscoe St" "Field Blvd & South Water St" "Wood St & Milwaul
##  $ end_station_id    : chr  "TA1309000025" "15534" "13221" "TA1305000030" ...
##  $ start_lat         : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num  -87.6 -87.6 -87.6 -87.6 -87.6 ...
##  $ end_lat           : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num  -87.6 -87.6 -87.7 -87.6 -87.7 ...
##  $ member_casual     : chr  "member" "member" "member" "member" ...
```

```r
str(jun)
```

```
## 'data.frame':    769204 obs. of  13 variables:
##  $ ride_id           : chr  "600CFD130D0FD2A4" "F5E6B5C1682C6464" "B6EB6D27BAD771D2" "C9C320375DE1D5
##  $ rideable_type     : chr  "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : chr  "2022-06-30 17:27:53" "2022-06-30 18:39:52" "2022-06-30 11:49:25" "2022-
##  $ ended_at          : chr  "2022-06-30 17:35:15" "2022-06-30 18:47:28" "2022-06-30 12:02:54" "2022-
##  $ start_station_name: chr  "" "" "" "" ...
##  $ start_station_id  : chr  "" "" "" "" ...
##  $ end_station_name  : chr  "" "" "" "" ...
##  $ end_station_id    : chr  "" "" "" "" ...
##  $ start_lat         : num  41.9 41.9 41.9 41.8 41.9 ...
##  $ start_lng         : num  -87.6 -87.6 -87.7 -87.7 -87.6 ...
##  $ end_lat           : num  41.9 41.9 41.9 41.8 41.9 ...
##  $ end_lng           : num  -87.6 -87.6 -87.6 -87.7 -87.6 ...
##  $ member_casual     : chr  "casual" "casual" "casual" "casual" ...
```

```
str(jul)
```

```
## 'data.frame':    823488 obs. of  13 variables:
##  $ ride_id           : chr  "954144C2F67B1932" "292E027607D218B6" "57765852588AD6E0" "B5B6BE443145901
##  $ rideable_type     : chr  "classic_bike" "classic_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-07-05 08:12:47" "2022-07-26 12:53:38" "2022-07-03 13:58:49" "2022-0
##  $ ended_at          : chr  "2022-07-05 08:24:32" "2022-07-26 12:55:31" "2022-07-03 14:06:32" "2022-0
##  $ start_station_name: chr  "Ashland Ave & Blackhawk St" "Buckingham Fountain (Temp)" "Buckingham Fou
##  $ start_station_id  : chr  "13224" "15541" "15541" "15541" ...
##  $ end_station_name  : chr  "Kingsbury St & Kinzie St" "Michigan Ave & 8th St" "Michigan Ave & 8th St
##  $ end_station_id    : chr  "KA1503000043" "623" "623" "TA1307000164" ...
##  $ start_lat         : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num  -87.7 -87.6 -87.6 -87.6 -87.6 ...
##  $ end_lat           : num  41.9 41.9 41.9 41.8 41.9 ...
##  $ end_lng           : num  -87.6 -87.6 -87.6 -87.6 -87.7 ...
##  $ member_casual     : chr  "member" "casual" "casual" "casual" ...
```

```
str(aug)
```

```
## 'data.frame':    785932 obs. of  13 variables:
##  $ ride_id           : chr  "550CF7EFEAE0C618" "DAD198F405F9C5F5" "E6F2BC47B65CB7FD" "F597830181C2E13
##  $ rideable_type     : chr  "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : chr  "2022-08-07 21:34:15" "2022-08-08 14:39:21" "2022-08-08 15:29:50" "2022-0
##  $ ended_at          : chr  "2022-08-07 21:41:46" "2022-08-08 14:53:23" "2022-08-08 15:40:34" "2022-0
##  $ start_station_name: chr  "" "" "" "" ...
##  $ start_station_id  : chr  "" "" "" "" ...
##  $ end_station_name  : chr  "" "" "" "" ...
##  $ end_station_id    : chr  "" "" "" "" ...
##  $ start_lat         : num  41.9 41.9 42 41.9 41.9 ...
##  $ start_lng         : num  -87.7 -87.6 -87.7 -87.7 -87.7 ...
##  $ end_lat           : num  41.9 41.9 42 42 41.8 ...
##  $ end_lng           : num  -87.7 -87.6 -87.7 -87.7 -87.7 ...
##  $ member_casual     : chr  "casual" "casual" "casual" "casual" ...
```

```
str(sep)
```

```
## 'data.frame':    701339 obs. of  13 variables:
##  $ ride_id           : chr  "5156990AC19CA285" "E12D4A16BF51C274" "A02B53CD7DB72DD7" "C82E05FEE872DF
##  $ rideable_type     : chr  "electric_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : chr  "2022-09-01 08:36:22" "2022-09-01 17:11:29" "2022-09-01 17:15:50" "2022-0
##  $ ended_at          : chr  "2022-09-01 08:39:05" "2022-09-01 17:14:45" "2022-09-01 17:16:12" "2022-0
##  $ start_station_name: chr  "" "" "" "" ...
##  $ start_station_id  : chr  "" "" "" "" ...
##  $ end_station_name  : chr  "California Ave & Milwaukee Ave" "" "" "" ...
##  $ end_station_id    : chr  "13084" "" "" "" ...
##  $ start_lat         : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num  -87.7 -87.6 -87.6 -87.7 -87.7 ...
##  $ end_lat           : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num  -87.7 -87.6 -87.6 -87.7 -87.7 ...
##  $ member_casual     : chr  "casual" "casual" "casual" "casual" ...
```

```r
str(oct)
```

```
## 'data.frame':    558685 obs. of  13 variables:
##  $ ride_id           : chr  "A50255C1E17942AB" "DB692A70BD2DD4E3" "3C02727AAF60F873" "47E653FDC2D992
##  $ rideable_type     : chr  "classic_bike" "electric_bike" "electric_bike" "electric_bike" ...
##  $ started_at        : chr  "2022-10-14 17:13:30" "2022-10-01 16:29:26" "2022-10-19 18:55:40" "2022-
##  $ ended_at          : chr  "2022-10-14 17:19:39" "2022-10-01 16:49:06" "2022-10-19 19:03:30" "2022-
##  $ start_station_name: chr  "Noble St & Milwaukee Ave" "Damen Ave & Charleston St" "Hoyne Ave & Balm
##  $ start_station_id  : chr  "13290" "13288" "655" "KA1504000133" ...
##  $ end_station_name  : chr  "Larrabee St & Division St" "Damen Ave & Cullerton St" "Western Ave & Le
##  $ end_station_id    : chr  "KA1504000079" "13089" "TA1307000140" "620" ...
##  $ start_lat         : num  41.9 41.9 42 41.9 41.9 ...
##  $ start_lng         : num  -87.7 -87.7 -87.7 -87.6 -87.6 ...
##  $ end_lat           : num  41.9 41.9 42 41.9 41.9 ...
##  $ end_lng           : num  -87.6 -87.7 -87.7 -87.6 -87.6 ...
##  $ member_casual     : chr  "member" "casual" "member" "member" ...
```

```r
str(nov)
```

```
## 'data.frame':    337735 obs. of  13 variables:
##  $ ride_id           : chr  "BCC66FC6FAB27CC7" "772AB67E902C180F" "585EAD07FDEC0152" "91C4E7ED3C262F
##  $ rideable_type     : chr  "electric_bike" "classic_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-11-10 06:21:55" "2022-11-04 07:31:55" "2022-11-21 17:20:29" "2022-
##  $ ended_at          : chr  "2022-11-10 06:31:27" "2022-11-04 07:46:25" "2022-11-21 17:34:36" "2022-
##  $ start_station_name: chr  "Canal St & Adams St" "Canal St & Adams St" "Indiana Ave & Roosevelt Rd"
##  $ start_station_id  : chr  "13011" "13011" "SL-005" "SL-005" ...
##  $ end_station_name  : chr  "St. Clair St & Erie St" "St. Clair St & Erie St" "St. Clair St & Erie S
##  $ end_station_id    : chr  "13016" "13016" "13016" "13016" ...
##  $ start_lat         : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ start_lng         : num  -87.6 -87.6 -87.6 -87.6 -87.6 ...
##  $ end_lat           : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num  -87.6 -87.6 -87.6 -87.6 -87.6 ...
##  $ member_casual     : chr  "member" "member" "member" "member" ...
```

```r
str(dec)
```

```
## 'data.frame':    181806 obs. of  13 variables:
##  $ ride_id           : chr  "65DBD2F447EC51C2" "0C201AA7EA0EA1AD" "E0B148CCB358A49D" "54C5775D2B7C91
##  $ rideable_type     : chr  "electric_bike" "classic_bike" "electric_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-12-05 10:47:18" "2022-12-18 06:42:33" "2022-12-13 08:47:45" "2022-
##  $ ended_at          : chr  "2022-12-05 10:56:34" "2022-12-18 07:08:44" "2022-12-13 08:59:51" "2022-
##  $ start_station_name: chr  "Clifton Ave & Armitage Ave" "Broadway & Belmont Ave" "Sangamon St & Lak
##  $ start_station_id  : chr  "TA1307000163" "13277" "TA1306000015" "KA1503000038" ...
##  $ end_station_name  : chr  "Sedgwick St & Webster Ave" "Sedgwick St & Webster Ave" "St. Clair St & I
##  $ end_station_id    : chr  "13191" "13191" "13016" "13134" ...
##  $ start_lat         : num  41.9 41.9 41.9 41.8 41.9 ...
##  $ start_lng         : num  -87.7 -87.6 -87.7 -87.6 -87.7 ...
##  $ end_lat           : num  41.9 41.9 41.9 41.9 41.9 ...
##  $ end_lng           : num  -87.6 -87.6 -87.6 -87.7 -87.7 ...
##  $ member_casual     : chr  "member" "casual" "member" "member" ...
```

Combine all months data into one dataframe

```
all_trips <- bind_rows(jan, feb, mar, apr, may, jun, jul, aug, sep, oct, nov, dec)
```

Inspect the new table that has been created

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

```
##  [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"
```

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

```
## [1] 5667717
```

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

```
## [1] 5667717      13
```

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

```
##            ride_id rideable_type          started_at            ended_at
## 1 C2F7DD78E82EC875 electric_bike 2022-01-13 11:59:47 2022-01-13 12:02:44
## 2 A6CF8980A652D272 electric_bike 2022-01-10 08:41:56 2022-01-10 08:46:17
## 3 BD0F91DFF741C66D  classic_bike 2022-01-25 04:53:40 2022-01-25 04:58:01
## 4 CBB80ED419105406  classic_bike 2022-01-04 00:18:04 2022-01-04 00:33:00
## 5 DDC963BFDDA51EEA  classic_bike 2022-01-20 01:31:10 2022-01-20 01:37:12
## 6 A39C6F6CC0586C0B  classic_bike 2022-01-11 18:48:09 2022-01-11 18:51:31
##              start_station_name start_station_id              end_station_name
## 1      Glenwood Ave & Touhy Ave              525          Clark St & Touhy Ave
## 2      Glenwood Ave & Touhy Ave              525          Clark St & Touhy Ave
## 3 Sheffield Ave & Fullerton Ave     TA1306000016 Greenview Ave & Fullerton Ave
## 4      Clark St & Bryn Mawr Ave     KA1504000151     Paulina St & Montrose Ave
## 5   Michigan Ave & Jackson Blvd     TA1309000002        State St & Randolph St
## 6         Wood St & Chicago Ave              637       Honore St & Division St
##   end_station_id start_lat start_lng  end_lat   end_lng member_casual
## 1         RP-007  42.01280 -87.66591 42.01256 -87.67437        casual
## 2         RP-007  42.01276 -87.66597 42.01256 -87.67437        casual
## 3   TA1307000001  41.92560 -87.65371 41.92533 -87.66580        member
## 4   TA1309000021  41.98359 -87.66915 41.96151 -87.67139        casual
## 5   TA1305000029  41.87785 -87.62408 41.88462 -87.62783        member
## 6   TA1305000034  41.89563 -87.67207 41.90312 -87.67394        member
```

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

```
## 'data.frame':    5667717 obs. of  13 variables:
##  $ ride_id           : chr  "C2F7DD78E82EC875" "A6CF8980A652D272" "BD0F91DFF741C66D" "CBB80ED4191054
##  $ rideable_type     : chr  "electric_bike" "electric_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-01-13 11:59:47" "2022-01-10 08:41:56" "2022-01-25 04:53:40" "2022-
##  $ ended_at          : chr  "2022-01-13 12:02:44" "2022-01-10 08:46:17" "2022-01-25 04:58:01" "2022-
##  $ start_station_name: chr  "Glenwood Ave & Touhy Ave" "Glenwood Ave & Touhy Ave" "Sheffield Ave & Fu
##  $ start_station_id  : chr  "525" "525" "TA1306000016" "KA1504000151" ...
##  $ end_station_name  : chr  "Clark St & Touhy Ave" "Clark St & Touhy Ave" "Greenview Ave & Fullerton
##  $ end_station_id    : chr  "RP-007" "RP-007" "TA1307000001" "TA1309000021" ...
##  $ start_lat         : num  42 42 41.9 42 41.9 ...
##  $ start_lng         : num  -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ end_lat           : num  42 42 41.9 42 41.9 ...
##  $ end_lng           : num  -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ member_casual     : chr  "casual" "casual" "member" "casual" ...
```

```r
summary(all_trips)
```

```
##    ride_id          rideable_type       started_at          ended_at
##  Length:5667717     Length:5667717     Length:5667717     Length:5667717
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  start_station_name start_station_id   end_station_name   end_station_id
##  Length:5667717     Length:5667717     Length:5667717     Length:5667717
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##    start_lat       start_lng         end_lat         end_lng
##  Min.   :41.64   Min.   :-87.84   Min.   : 0.00   Min.   :-88.14
##  1st Qu.:41.88   1st Qu.:-87.66   1st Qu.:41.88   1st Qu.:-87.66
##  Median :41.90   Median :-87.64   Median :41.90   Median :-87.64
##  Mean   :41.90   Mean   :-87.65   Mean   :41.90   Mean   :-87.65
##  3rd Qu.:41.93   3rd Qu.:-87.63   3rd Qu.:41.93   3rd Qu.:-87.63
##  Max.   :45.64   Max.   :-73.80   Max.   :42.37   Max.   :  0.00
##                                   NA's   :5858    NA's   :5858
##  member_casual
##  Length:5667717
##  Class :character
##  Mode  :character
##
##
##
##
```

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

Add a "ride_length" calculation to all_trips (in seconds)

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

Review the structure of all the columns that were just created

```
str(all_trips)
```

```
## 'data.frame':    5667717 obs. of  19 variables:
##  $ ride_id           : chr  "C2F7DD78E82EC875" "A6CF8980A652D272" "BD0F91DFF741C66D" "CBB80ED4191054
##  $ rideable_type     : chr  "electric_bike" "electric_bike" "classic_bike" "classic_bike" ...
##  $ started_at        : chr  "2022-01-13 11:59:47" "2022-01-10 08:41:56" "2022-01-25 04:53:40" "2022-
##  $ ended_at          : chr  "2022-01-13 12:02:44" "2022-01-10 08:46:17" "2022-01-25 04:58:01" "2022-
##  $ start_station_name: chr  "Glenwood Ave & Touhy Ave" "Glenwood Ave & Touhy Ave" "Sheffield Ave & Fu
##  $ start_station_id  : chr  "525" "525" "TA1306000016" "KA1504000151" ...
##  $ end_station_name  : chr  "Clark St & Touhy Ave" "Clark St & Touhy Ave" "Greenview Ave & Fullerton
##  $ end_station_id    : chr  "RP-007" "RP-007" "TA1307000001" "TA1309000021" ...
##  $ start_lat         : num  42 42 41.9 42 41.9 ...
##  $ start_lng         : num  -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ end_lat           : num  42 42 41.9 42 41.9 ...
##  $ end_lng           : num  -87.7 -87.7 -87.7 -87.7 -87.6 ...
##  $ member_casual     : chr  "casual" "casual" "member" "casual" ...
##  $ date              : Date, format: "2022-01-13" "2022-01-10" ...
##  $ month             : chr  "01" "01" "01" "01" ...
##  $ day               : chr  "13" "10" "25" "04" ...
##  $ year              : chr  "2022" "2022" "2022" "2022" ...
##  $ day_of_week       : chr  "Thursday" "Monday" "Tuesday" "Tuesday" ...
##  $ ride_length       : 'difftime' num  177 261 261 896 ...
##   ..- attr(*, "units")= chr "secs"
```

Convert "ride_length" to numeric so we can run calculations on the data

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

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

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

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

Ensure all "bad" data is removed (bikes taken out of docks for inspection and neg ride_length)

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

Descriptive analysis on ride_length (all figures in seconds)

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

```
## [1] 1166.794
```

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

```
## [1] 617
```

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

```
## [1] 2483235
```

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

```
## [1] 0
```

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

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##       0     349     617    1167    1108 2483235
```

Compare members and casual users

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

```
##   all_trips_v2$member_casual all_trips_v2$ride_length
## 1                     casual                1748.8022
## 2                     member                 762.8632
```

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

```
##   all_trips_v2$member_casual all_trips_v2$ride_length
## 1                     casual                      780
## 2                     member                      530
```

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

```
##   all_trips_v2$member_casual all_trips_v2$ride_length
## 1                     casual                  2483235
## 2                     member                    89998
```

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

```
##   all_trips_v2$member_casual all_trips_v2$ride_length
## 1                     casual                        0
## 2                     member                        0
```

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

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

```
##    all_trips_v2$member_casual all_trips_v2$day_of_week all_trips_v2$ride_length
## 1                      casual                   Friday                1682.6659
## 2                      member                   Friday                 751.8463
## 3                      casual                   Monday                1751.2287
## 4                      member                   Monday                 736.2065
## 5                      casual                 Saturday                1956.7994
## 6                      member                 Saturday                 848.3793
## 7                      casual                   Sunday                2043.8469
## 8                      member                   Sunday                 842.0978
## 9                      casual                 Thursday                1532.9450
## 10                     member                 Thursday                 737.5637
## 11                     casual                  Tuesday                1549.3584
## 12                     member                  Tuesday                 727.7694
## 13                     casual                Wednesday                1485.0376
## 14                     member                Wednesday                 726.2934
```

Reorder the days of the week

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

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

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

```
##    all_trips_v2$member_casual all_trips_v2$day_of_week all_trips_v2$ride_length
## 1                      casual                   Sunday                2043.8469
## 2                      member                   Sunday                 842.0978
## 3                      casual                   Monday                1751.2287
## 4                      member                   Monday                 736.2065
```

```
## 5                    casual                Tuesday              1549.3584
## 6                    member                Tuesday               727.7694
## 7                    casual              Wednesday              1485.0376
## 8                    member              Wednesday               726.2934
## 9                    casual               Thursday              1532.9450
## 10                   member               Thursday               737.5637
## 11                   casual                 Friday              1682.6659
## 12                   member                 Friday               751.8463
## 13                   casual               Saturday              1956.7994
## 14                   member               Saturday               848.3793
```

Analyze ridership data by type and weekday

```
all_trips_v2 %>%
  mutate(weekday = wday(started_at, label = TRUE)) %>%
  group_by(member_casual, weekday) %>%
  summarise(number_of_rides = n()
            ,average_duration = mean(ride_length)) %>%
  arrange(member_casual, weekday)
```

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

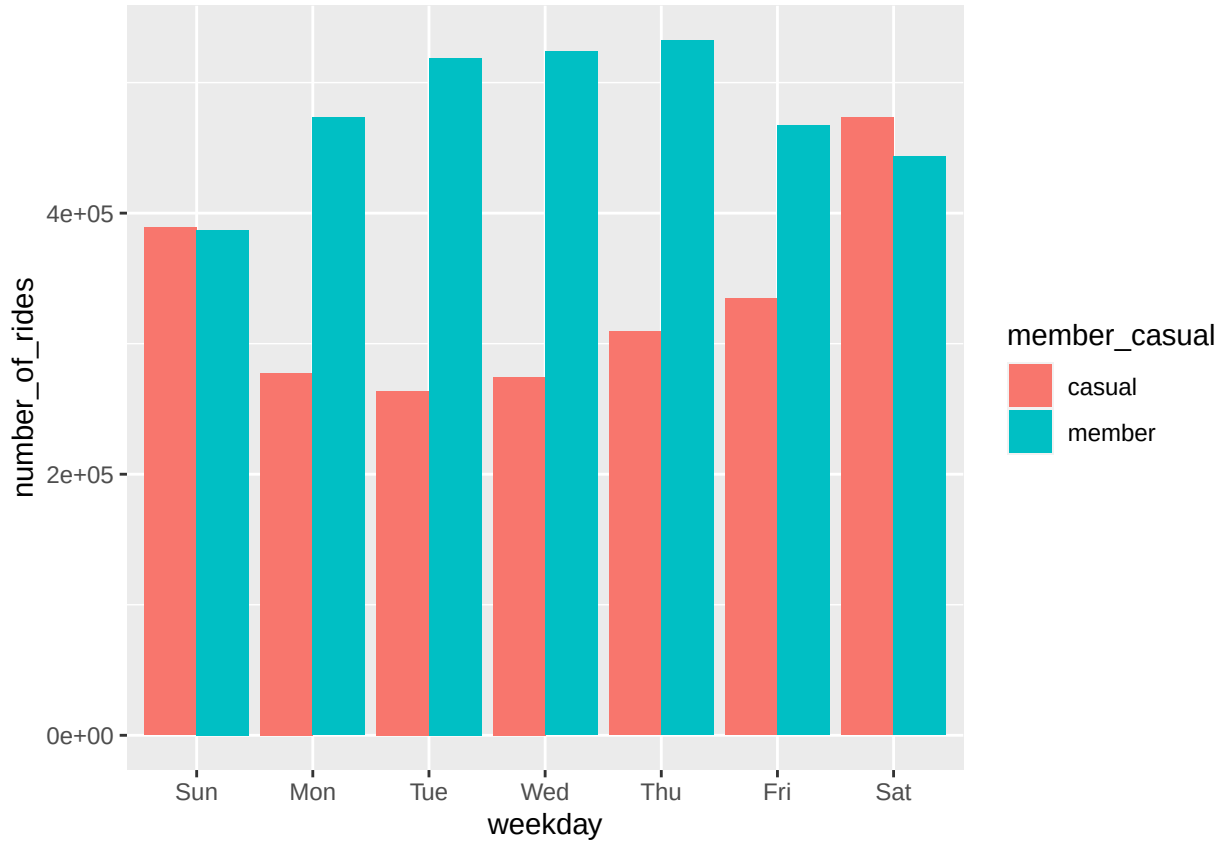
```
## # A tibble: 14 x 4
## # Groups:   member_casual [2]
##    member_casual weekday number_of_rides average_duration
##    <chr>         <ord>             <int>            <dbl>
##  1 casual        Sun              389011            2044.
##  2 casual        Mon              277671            1751.
##  3 casual        Tue              263731            1549.
##  4 casual        Wed              274354            1485.
##  5 casual        Thu              309327            1533.
##  6 casual        Fri              334698            1683.
##  7 casual        Sat              473185            1957.
##  8 member        Sun              387208             842.
##  9 member        Mon              473335             736.
## 10 member        Tue              518618             728.
## 11 member        Wed              523867             726.
## 12 member        Thu              532255             738.
## 13 member        Fri              467083             752.
## 14 member        Sat              443274             848.
```

Visualize the number of rides by rider type

```
all_trips_v2 %>%
  mutate(weekday = wday(started_at, label = TRUE)) %>%
  group_by(member_casual, weekday) %>%
  summarise(number_of_rides = n()
            ,average_duration = mean(ride_length)) %>%
  arrange(member_casual, weekday)  %>%
```

```
  ggplot(aes(x = weekday, y = number_of_rides, fill = member_casual)) +
  geom_col(position = "dodge")
```

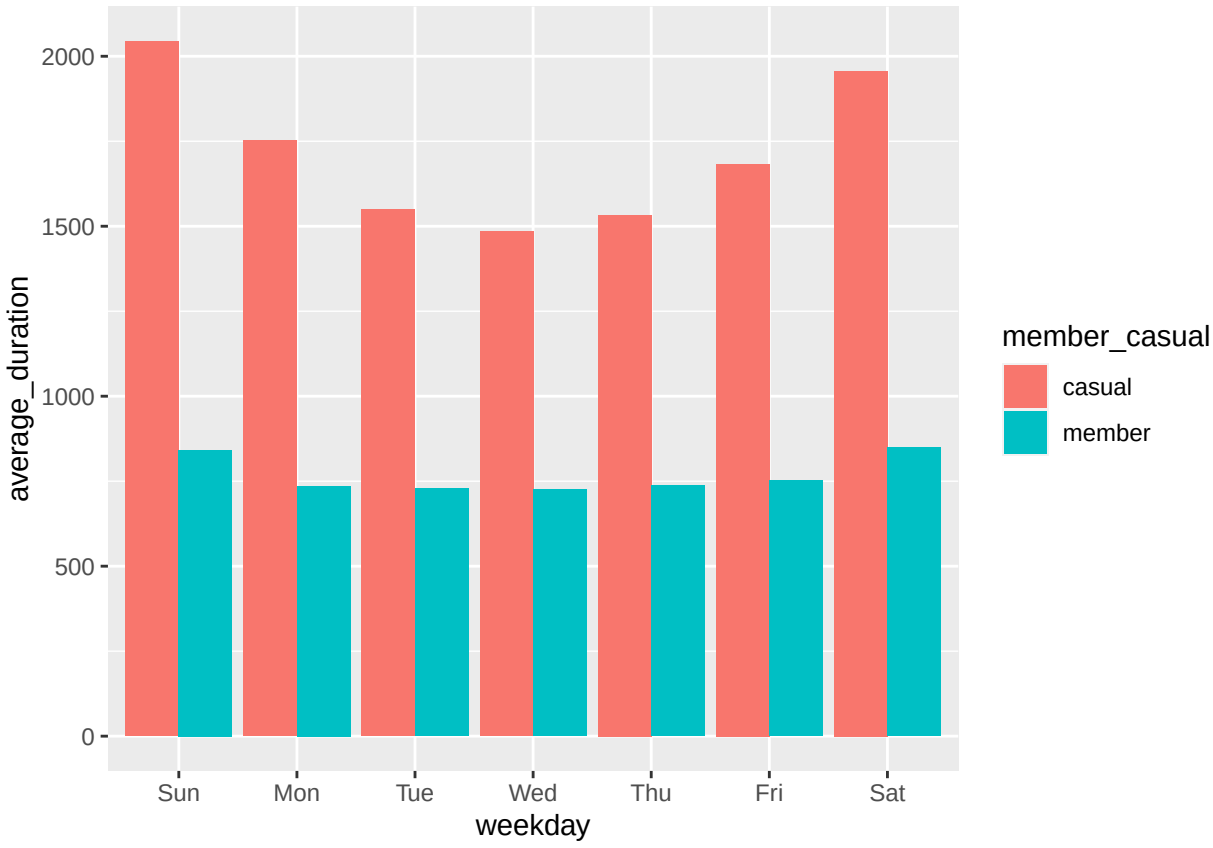
```
## `summarise()` has grouped output by 'member_casual'. You can override using the
## `.groups` argument.
```



Create a visualization for average duration

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

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



Create a csv file that we will further analyze in Tableau

```
counts <- aggregate(all_trips_v2$ride_length ~ all_trips_v2$member_casual + all_trips_v2$day_of_week, FU
write.csv(counts, file = "C:/Users/toled/OneDrive/Desktop/Case Study 1/avg_ride_length.csv")

write.csv(all_trips, file= "C:/Users/toled/OneDrive/Desktop/Case Study 1/all_trips.csv")
```