Analysis of Traffic Stops and Violations

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Introduction

Load Packages

```
#install.packages('rmarkdown')
#install.packages('readxl') -- Used for importing xlsx spreadsheets.
#install.packages('tidyverse')
#install.packages('ggrounded') -- Used for fancier bars.
library(rmarkdown)
library(readxl)
library(tidyverse)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.0     v stringr   1.5.1
v ggplot2   3.5.2     v tibble    3.2.1
v lubridate 1.9.4     v tidyr     1.3.1
v purrr     1.0.4
-- 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 becor
```

```
library(ggrounded)
```

Load the Data

```
traff_violations <- read_excel('AttemptTwo.xlsx')
traff_violations
```

```
# A tibble: 10,000 x 25
   `Date Of Stop`      `Time Of Stop`      Description            Accident Belts
   <dttm>              <dttm>              <chr>                  <chr>    <chr>
 1 2015-10-20 00:00:00 1899-12-31 15:02:00 EXCEEDING MAXIMUM SPE~ No       No
 2 2013-12-02 00:00:00 1899-12-31 16:23:00 FAILURE TO DISPLAY RE~ No       No
 3 2013-08-20 00:00:00 1899-12-31 22:48:00 EXCEEDING THE POSTED ~ No       No
 4 2017-08-27 00:00:00 1899-12-31 16:39:00 DRIVER FAILURE TO OBE~ No       No
 5 2012-03-25 00:00:00 1899-12-31 13:16:00 DRIVING VEHICLE ON HI~ No       No
 6 2014-04-10 00:00:00 1899-12-31 03:44:00 DRIVING WHILE IMPAIRE~ No       No
 7 2023-11-17 00:00:00 1899-12-31 20:04:00 FAILURE TO ATTACH VEH~ No       No
 8 2018-10-15 00:00:00 1899-12-31 23:47:00 EXCEEDING POSTED MAXI~ No       No
 9 2013-04-17 00:00:00 1899-12-31 17:44:00 DRIVER FAILURE TO OBE~ No       No
10 2019-07-01 00:00:00 1899-12-31 09:08:00 DRIVER USING HANDS TO~ No       No
# i 9,990 more rows
# i 20 more variables: `Personal Injury` <chr>, `Property Damage` <chr>,
#   Fatal <chr>, `Commercial License` <chr>, HAZMAT <chr>,
#   `Commercial Vehicle` <chr>, Alcohol <chr>, `Work Zone` <chr>,
#   `Search Conducted` <chr>, VehicleType <chr>, Year <dbl>, Make <chr>,
#   Model <chr>, Color <chr>, `Contributed To Accident` <lgl>, Race <chr>,
#   Gender <chr>, `Driver City` <chr>, `Driver State` <chr>, ...
```

Tidy the Data

```
# Modifications for proper time and day.
traff_violations <- traff_violations %>%
  mutate(
    TimeOnly = format(`Time Of Stop`, "%H:%M:%S"),
    FullDateTime = ymd_hms(paste(`Date Of Stop`, TimeOnly)),
    Hour = hour(FullDateTime),
    Day = wday(FullDateTime, label = TRUE, abbr = FALSE)
  )
```

```r
#Description of Violation
most_common_desc <- traff_violations %>%
  count(Description) %>%
  arrange(desc(n)) %>%
  slice(1:5)
print(most_common_desc)
```

```
# A tibble: 5 x 2
  Description                                                          n
  <chr>                                                            <int>
1 DRIVER FAILURE TO OBEY PROPERLY PLACED TRAFFIC CONTROL DEVICE INSTRUCTI~   642
2 FAILURE TO DISPLAY REGISTRATION CARD UPON DEMAND BY POLICE OFFICER          356
3 FAILURE OF INDIVIDUAL DRIVING ON HIGHWAY TO DISPLAY LICENSE TO UNIFORME~   353
4 PERSON DRIVING MOTOR VEHICLE ON HIGHWAY OR PUBLIC USE PROPERTY ON SUSPE~   293
5 DRIVING VEHICLE ON HIGHWAY WITH SUSPENDED REGISTRATION                    284
```

```r
#Vehicle Year
most_common_vyear <- traff_violations %>%
  count(Year) %>%
  arrange(desc(n)) %>%
  slice(1:10)
print(most_common_vyear)
```

```
# A tibble: 10 x 2
    Year     n
   <dbl> <int>
 1  2007   537
 2  2006   535
 3  2012   522
 4  2013   515
 5  2008   506
 6  2005   504
 7  2014   481
 8  2010   476
 9  2003   463
10  2004   445
```

```r
#Vehicle Make
most_common_vmake <- traff_violations %>%
  mutate(Make = str_replace_all(Make, c(
    "CHEVY" = "CHEVROLET",
```

```
    "CHEV" = "CHEVROLET",
    "TOYT" = "TOYOTA",
    "HOND" = "HONDA",
    "HONDAA" = "HONDA",
    "CHEVROLETROLET" = "CHEVROLET",
    "VOLK" = "VOLKSWAGON",
    "VW" = "VOLKSWAGON",
    "HYUN" = "HYUNDAI",
    "TOTOTA" = "TOYOTA",
    "TOTYOA" = "TOYOTA",
    "TOYORA" = "TOYOTA",
    "HYUNDAIDAI" = "HYUNDAI",
    "MERZ" = "MERCEDES",
    "NISS" = "NISSAN",
    "DODG" = "DODGE",
    "MAZD" = "MAZDA",
    "MAZDAA" = "MAZDA",
    "DODGEE" = "DODGE",
    "ACUR" = "ACURA",
    "ACURAA" = "ACURA",
    "NISSANAN" = "NISSAN",
    "SUBA" = "SUBARU",
    "SUBARURU" = "SUBARU",
    "VOLKSWAGONSWAGEN" = "VOLKSWAGON",
    "VOLKSWAGONSWAGON" = "VOLKSWAGON",
    "INFI" = "INFINITI",
    "INFINITINITI" = "INFINITI",
    "MITS" = "MITSUBISHI",
    "MITSUBISHIUBISHI" = "MITSUBISHI",
    "VOLKSWAGONS" = "VOLKSWAGON",
    "TOYOT" = "TOYOTA",
    "TOYOTAAA" = "TOYOTA",
    "TOYO" = "TOYOTA",
    "TOYOTATA" = "TOYOTA",
    "TOYOTAA" = "TOYOTA",
    "HYUNDAID" = "HYUNDAI",
    "MAZADA" = "MAZDA",
    "CHRY" = "CRYSLER",
    "CHEVROLETORLET" = "CHEVROLET",
    "TOYOTAOA" = "TOYOTA",
    "VOLV" = "VOLVO",
    "VOLVOO" = "VOLVO",
```

```
    "MERCEDES" = "MERCEDES BENZ",
    "MERC" = "MERCEDES BENZ",
    "MERCEDES BENZURY" = "MERCEDES BENZ",
    "MERCEDES BENZEDES BENZ" = "MERCEDES BENZ",
    "MERCEDES BENZEDEZ" = "MERCEDES BENZ",
    "MERCEDES BENZ BENZ" = "MERCEDES BENZ",
    "MERCEDES BENZ-BENZ" = "MERCEDES BENZ",
    "CRYSLERSLER" = "CHRYSLER",
    "CRYSLER" = "CHRYSLER",
    "CHEVROLETE" = "CHEVROLET",
    "CHEVROLETY" = "CHEVROLET",
    "CHEVROLETROLET" = "CHEVROLET",
    "CHECY" = "CHEVROLET",
    "CVEVROLET" = "CHEVROLET",
    "HYUNDAII" = "HYUNDAI",
    "HYUNDAIIA" = "HYUNDAI",
    "HYUNDAIA" = "HYUNDAI",
    "TOY" = "TOYOTA",
    "TOYOTAOTA" = "TOYOTA",
    "HINDA" = "HONDA"
  ))) %>%
  count(Make) %>%
  arrange(desc(n)) %>%
  slice(1:5)
print(most_common_vmake)
```

```
# A tibble: 5 x 2
  Make          n
  <chr>     <int>
1 TOYOTA     1723
2 HONDA      1424
3 FORD        989
4 CHEVROLET   767
5 NISSAN      745
```

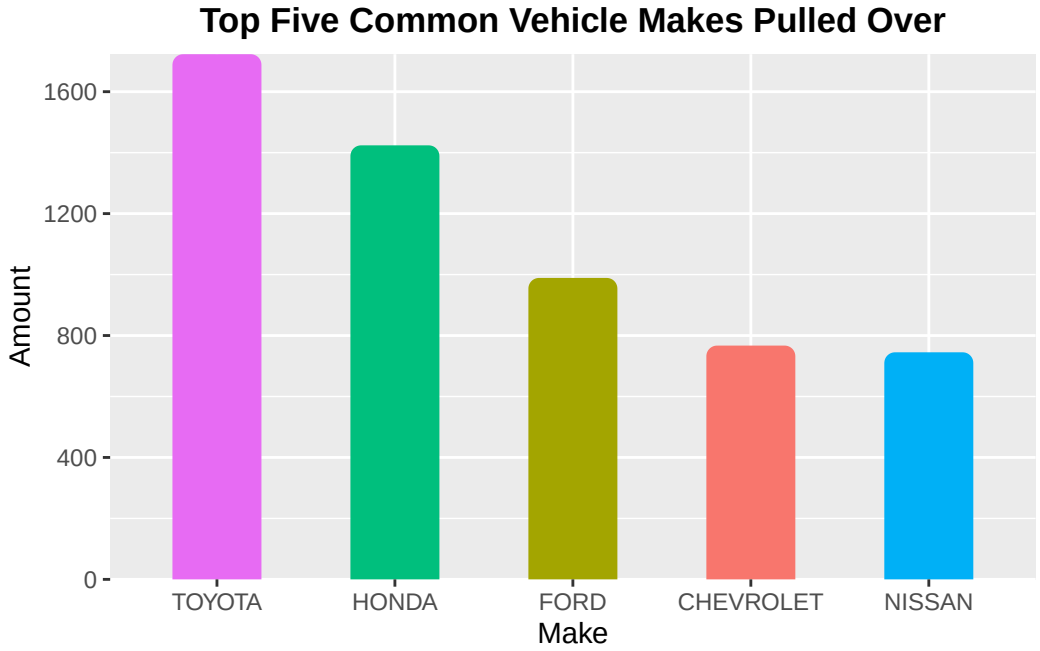
```
#Race of Driver
most_common_race <- traff_violations %>%
  count(Race) %>%
  arrange(desc(n))
  #%>% slice(1:5)
print(most_common_race)
```

```
# A tibble: 6 x 2
  Race                n
  <chr>           <int>
1 WHITE            3240
2 BLACK            3161
3 HISPANIC         2420
4 OTHER             674
5 ASIAN             493
6 NATIVE AMERICAN    12
```

Analyze the Tidy Data

Plot 1 - Top Five Common Vehicle Makes Pulled Over

```
ggplot(data = most_common_vmake, aes(x= reorder(Make, -n), y= n, fill = Make)) +
 geom_col_rounded(width = 0.5) + scale_y_continuous(expand = c(0, 0))+
 labs(title = "Top Five Common Vehicle Makes Pulled Over") + xlab("Make") + ylab("Amount") +
```

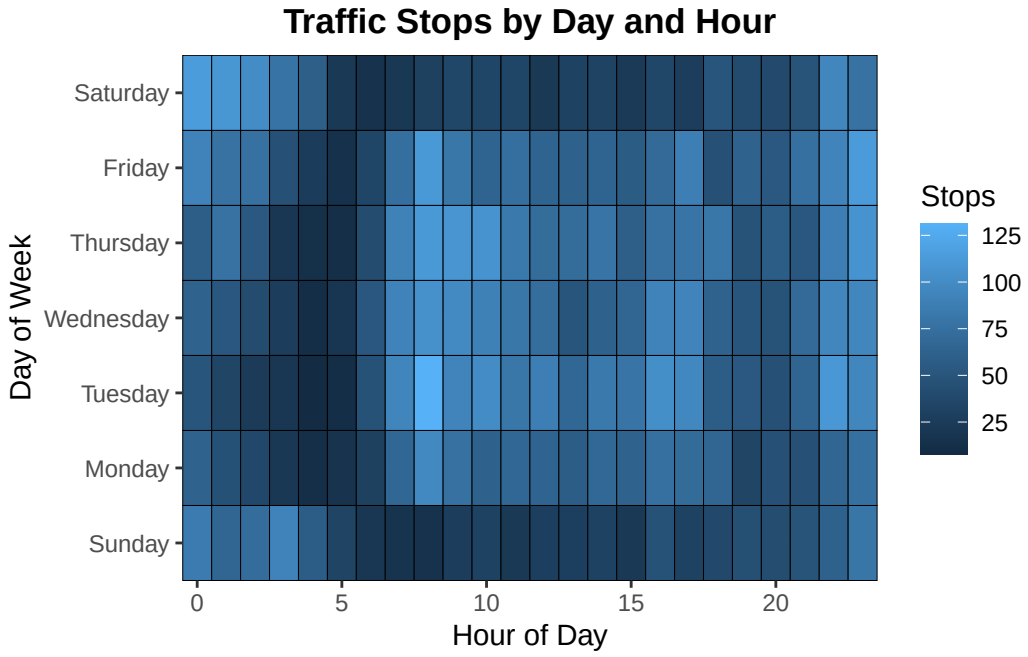



```
print(most_common_vmake)
```

```
# A tibble: 5 x 2
  Make           n
  <chr>      <int>
1 TOYOTA      1723
2 HONDA       1424
3 FORD         989
4 CHEVROLET    767
5 NISSAN       745
```

Plot 2 - Traffic Stops by Day and Hour

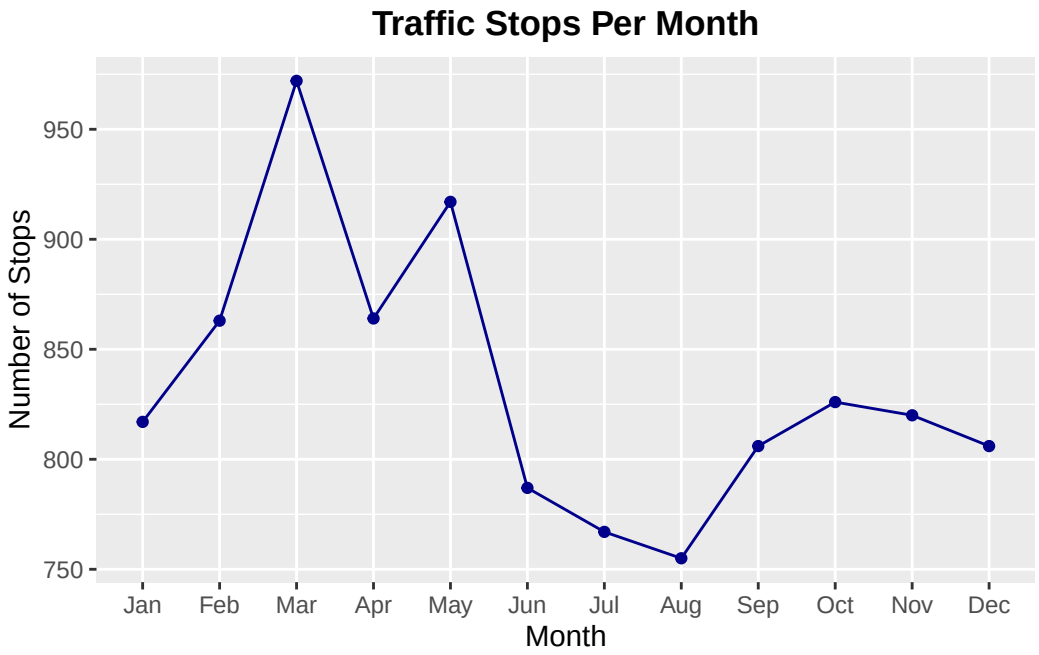
```
traff_violations %>%
  count(Hour, Day) %>%
  ggplot(aes(Hour, Day, fill = n)) + geom_tile(color = 'black') + scale_x_continuous(expand =
  theme(plot.title = element_text(hjust = 0.5, face = "bold"))
```



Plot 3 - Traffic Stops Per Month

```r
monthly_stops <- traff_violations %>%
  mutate(Month = month(`Date Of Stop`, label = TRUE, abbr = TRUE)) %>%
  count(Month)

ggplot(monthly_stops, aes(Month, n))+geom_line(group = 1, color = 'darkblue')+geom_point(colo
```



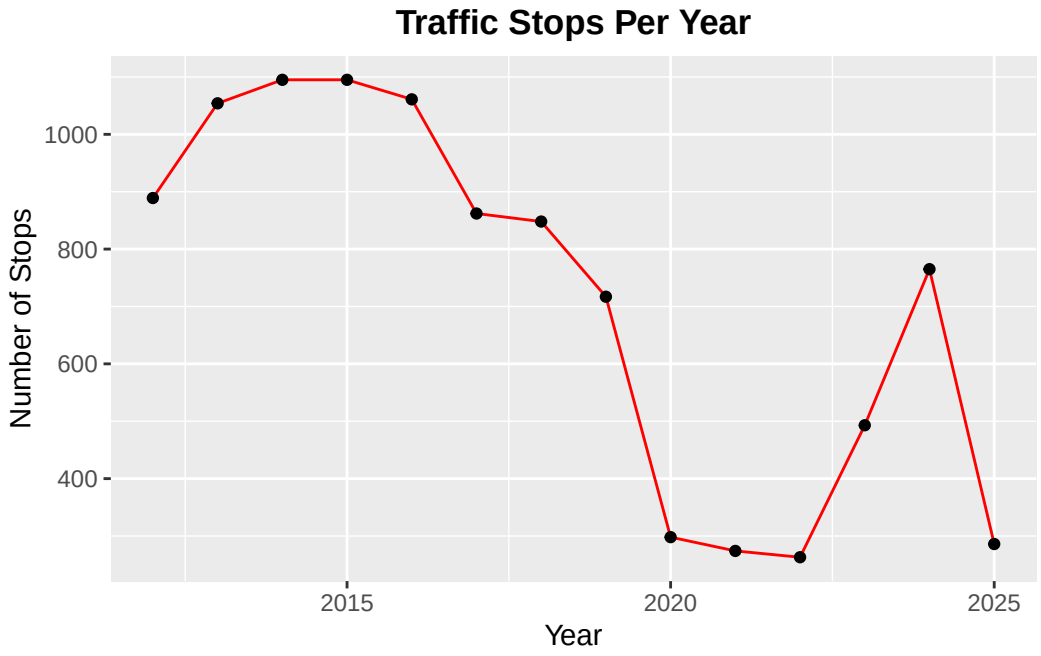

```r
monthly_stops
```

```
# A tibble: 12 x 2
   Month     n
   <ord> <int>
 1 Jan     817
 2 Feb     863
 3 Mar     972
 4 Apr     864
 5 May     917
 6 Jun     787
 7 Jul     767
 8 Aug     755
 9 Sep     806
10 Oct     826
11 Nov     820
12 Dec     806
```

Plot 4 - Traffic Stops Per Year

```
yearly_stops <- traff_violations %>%
  mutate(Year = year(`Date Of Stop`)) %>%
  count(Year)

ggplot(yearly_stops, aes(Year, n))+geom_line(group = 1, color = 'red')+geom_point(color ='bla
```



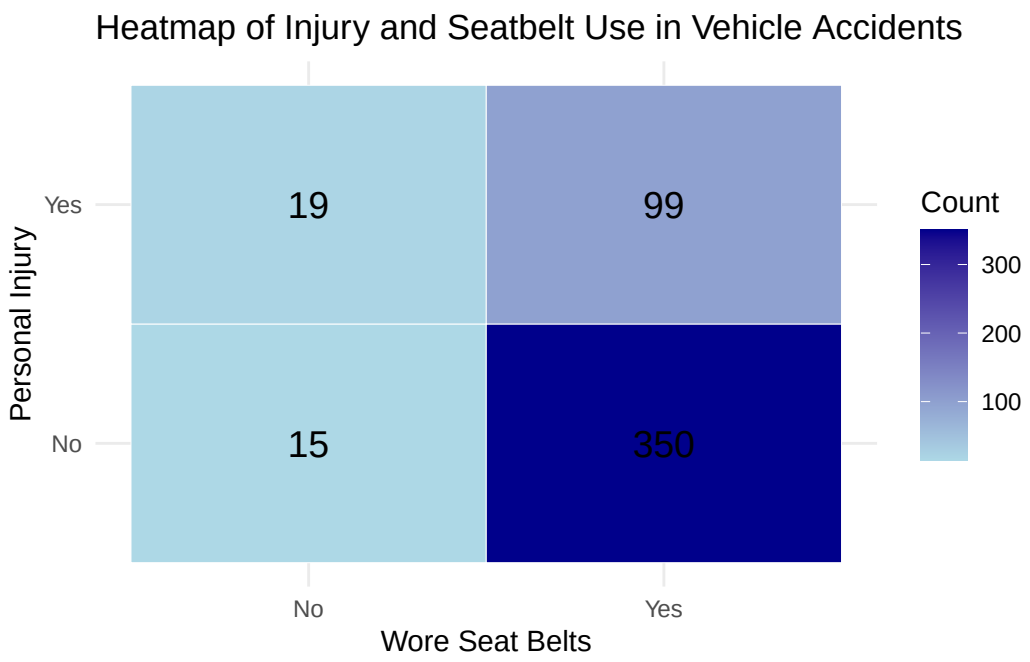

```
yearly_stops
```

```
# A tibble: 14 x 2
    Year     n
   <dbl> <int>
 1  2012   889
 2  2013  1054
 3  2014  1095
 4  2015  1095
 5  2016  1061
 6  2017   862
 7  2018   848
 8  2019   717
 9  2020   298
```

```
10   2021    274
11   2022    263
12   2023    493
13   2024    765
14   2025    286
```

Plot 5 - Correlation of Injury and Seatbelt Use in Accidents

```
traff_violations_filtered <- traff_violations %>% filter(Accident == "Yes")
traff_violations_filtered <- traff_violations_filtered %>%
  mutate(Belts = ifelse(Belts == "Yes", "N", Belts))
traff_violations_filtered <- traff_violations_filtered %>%
  mutate(Belts = ifelse(Belts == "No", "Yes", Belts))
traff_violations_filtered <- traff_violations_filtered %>%
  mutate(Belts = ifelse(Belts == "N", "No", Belts))
traff_violations_filtered %>%
  count(`Belts`, `Personal Injury`) %>%
  ggplot(aes(x = `Belts`, y = `Personal Injury`, fill = n)) +
  geom_tile(color = "white") +
  geom_text(aes(label = n), color = "black", size = 5) +
  scale_fill_gradient(low = "lightblue", high = "darkblue") +
  labs(title = "Heatmap of Injury and Seatbelt Use in Vehicle Accidents",
       x = "Wore Seat Belts", y = "Personal Injury", fill = "Count") +
  theme_minimal()
```



Plot 6 - Traffic Violations by Race and Gender

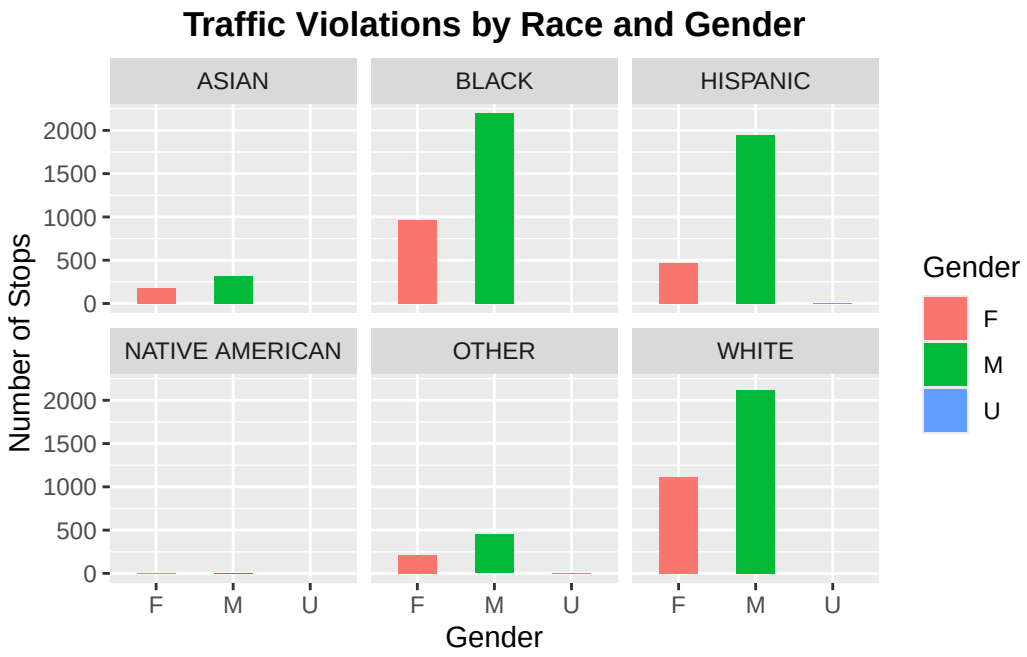
```
race_gender_counts <- traff_violations %>%
  count(Race, Gender)

race_gender_counts
```

```
# A tibble: 14 x 3
   Race            Gender     n
   <chr>           <chr>  <int>
 1 ASIAN           F        177
 2 ASIAN           M        316
 3 BLACK           F        962
 4 BLACK           M       2199
 5 HISPANIC        F        469
 6 HISPANIC        M       1950
 7 HISPANIC        U          1
 8 NATIVE AMERICAN F          5
 9 NATIVE AMERICAN M          7
10 OTHER           F        217
11 OTHER           M        450
```

```
12 OTHER           U          7
13 WHITE           F       1118
14 WHITE           M       2122
```

```
ggplot(race_gender_counts, aes(x = Gender, y = n, fill = Gender)) +
  geom_col(width = 0.5) +
  facet_wrap(~ Race)+ labs(title = "Traffic Violations by Race and Gender")+
  ylab("Number of Stops")+theme(plot.title = element_text(hjust = 0.5, face = "bold"))
```



Plot 7 – Traffic Violations per Geographic Area

```
traff_violations_filtered_2 <- traff_violations %>%
  mutate(`Driver State` = ifelse(`Driver State` != "MD", "Out of State", `Driver State`))
traff_violations_filtered_2 <- traff_violations_filtered_2 %>%
  mutate(`Driver State` = ifelse(`Driver State` == "MD", "Maryland", `Driver State`))
traff_violations_filtered_2 %>%
  count(`Driver State`) %>%
  ggplot(aes(x = reorder(`Driver State`, n), y = n)) +
  geom_bar(stat = "identity", fill = "steelblue") +
  geom_text(aes(label = n), hjust = 1.1, size = 4) +
  coord_flip() +
```

```
  labs(title = "Counts of MD vs non MD Drivers",
       x = "Category",
       y = "Count") +
  #scale_y_continuous(expand = expansion(mult = c(0, 0.1))) +
  scale_y_continuous(breaks = seq(0, max(9000), by = 1000)) +
  theme_minimal()
```