CRIM 595 Temporal Project

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Packages

Here are the packages that I used for this project:

```
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.3.1
```

```
## Warning: package 'lubridate' was built under R version 4.3.1
```

```
library(lubridate)
library(ragg)
```

```
## Warning: package 'ragg' was built under R version 4.3.1
```

Data

Acquire Data

Fairfax Police Calls For Service

```
id.calls <- "1gRoL7lZlwm7sreA5F9WbPoH5su4n4iGS"
calls.temp <- read.csv(sprintf("https://docs.google.com/uc?id=%s&export=download", id.calls))
```

Wrangle Data

Format date and create columns for day of week and month

```
calls.temp$date <- as.Date(calls.temp$date)
calls.temp$dow <- weekdays(calls.temp$date)
calls.temp$day <- day(calls.temp$date)
calls.temp$month <- substr(calls.temp$date, 6, 7)
```

Subset calls for Larceny

```
calls.type <- calls.temp %>%
  group_by(type) %>%
  summarise(count = n()) %>%
  mutate(PCT = round(count/sum(count)*100,2))
calls <- subset(calls.temp, calls.temp$type == 'LARCENY')
```

Findings

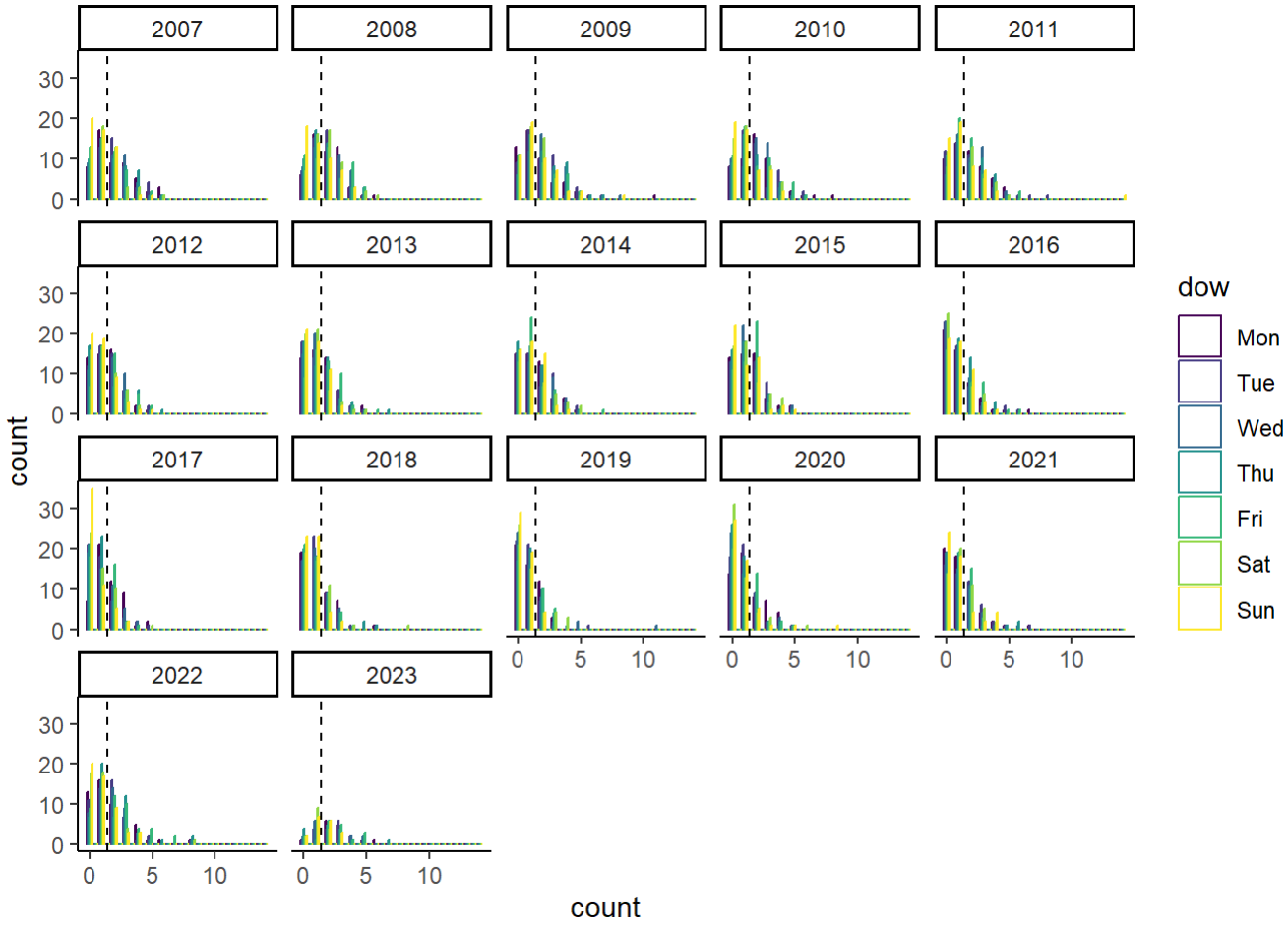
Basic Statistics

Larceny statistics in Fairfax, VA 2007-2023

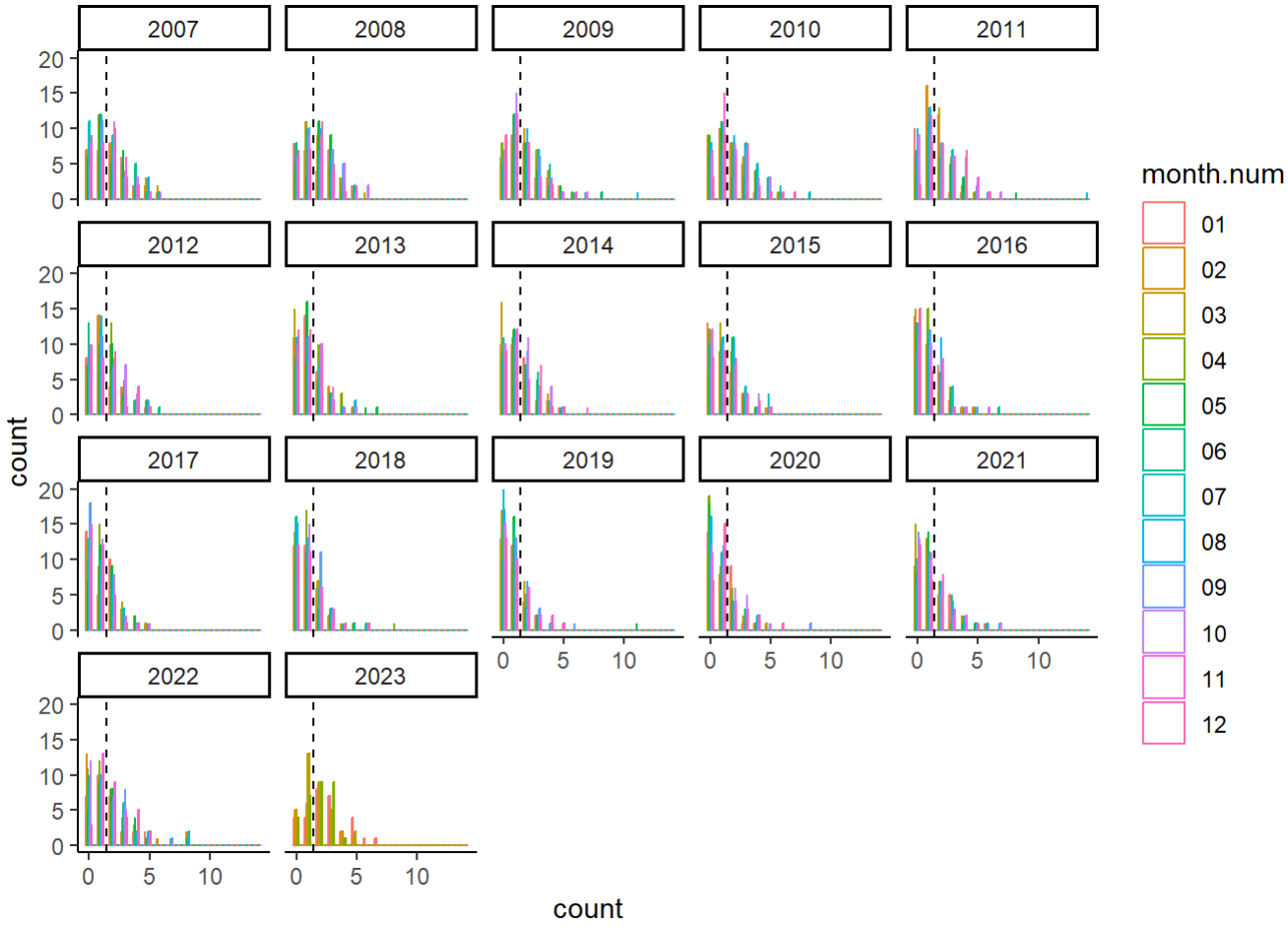
```
calls.day <- calls %>%
  group_by(date) %>%
  summarise(count = n())

first <- min(calls.day$date)
last <- max(calls.day$date)

calls.day <- calls.day %>%
  complete(date = seq(ymd(first),
                      ymd(last),
                      "day")) %>%
  mutate(dow = wday(date, label = T, week_start = 1),
         month.name = month(date, label = T, abbr = F),
         month.num = substr(date, 6,7),
         week = isoweek(date),
         day = day(date),
         year = year(date))

calls.day$count[is.na(calls.day$count)] = "0"
calls.day$count <- as.numeric(calls.day$count)

high <- as.numeric(max(calls.day$count))
low <- as.numeric(min(calls.day$count))
mean <- mean(calls.day$count)
sd <- sd(calls.day$count)

calls.day <- mutate(calls.day,
                    week = case_when(month.name == "December" & week == 1 ~ 53,
                                     month.name == "January" & week %in% 52:53 ~ 0,
                                     TRUE ~ week),
                    category = cut(count, c(low-1, (mean-sd*3), (mean-sd*2),
                                            (mean-sd), mean, (mean+sd),
                                            (mean+sd*2), (mean+sd*3), high+1)))
```

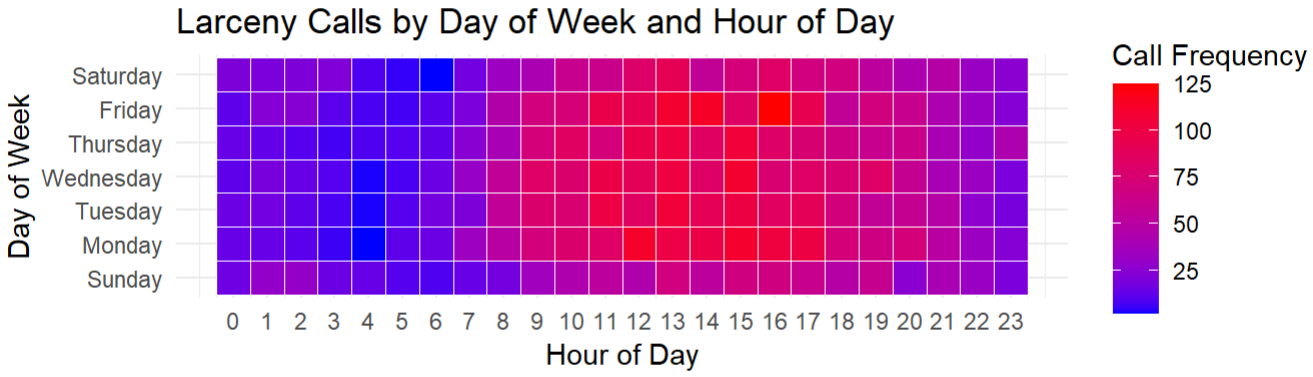
Graphs

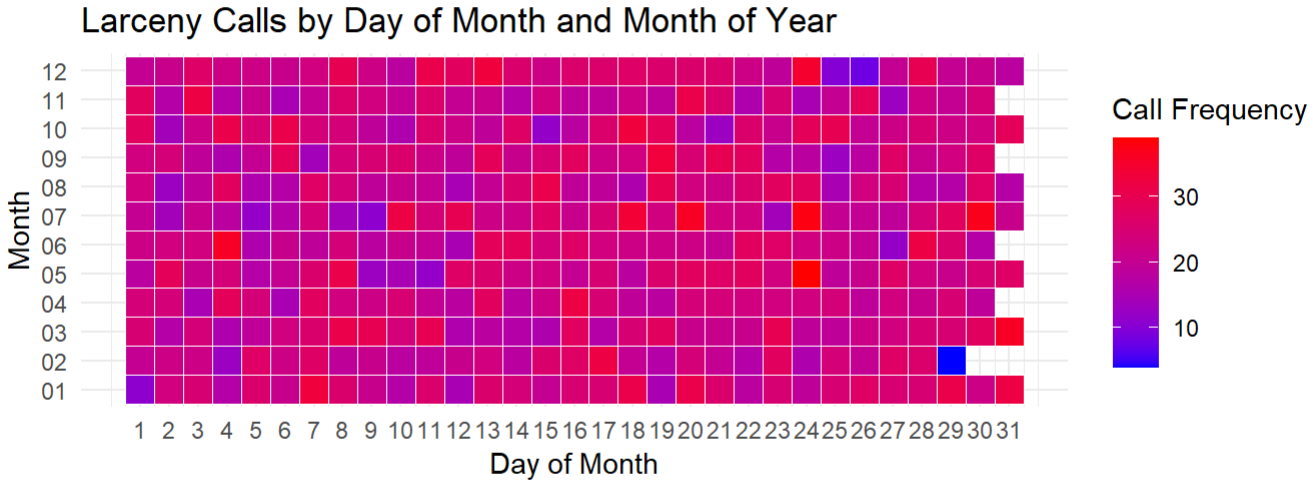
Larceny Calls by Day of Week 2007-2023

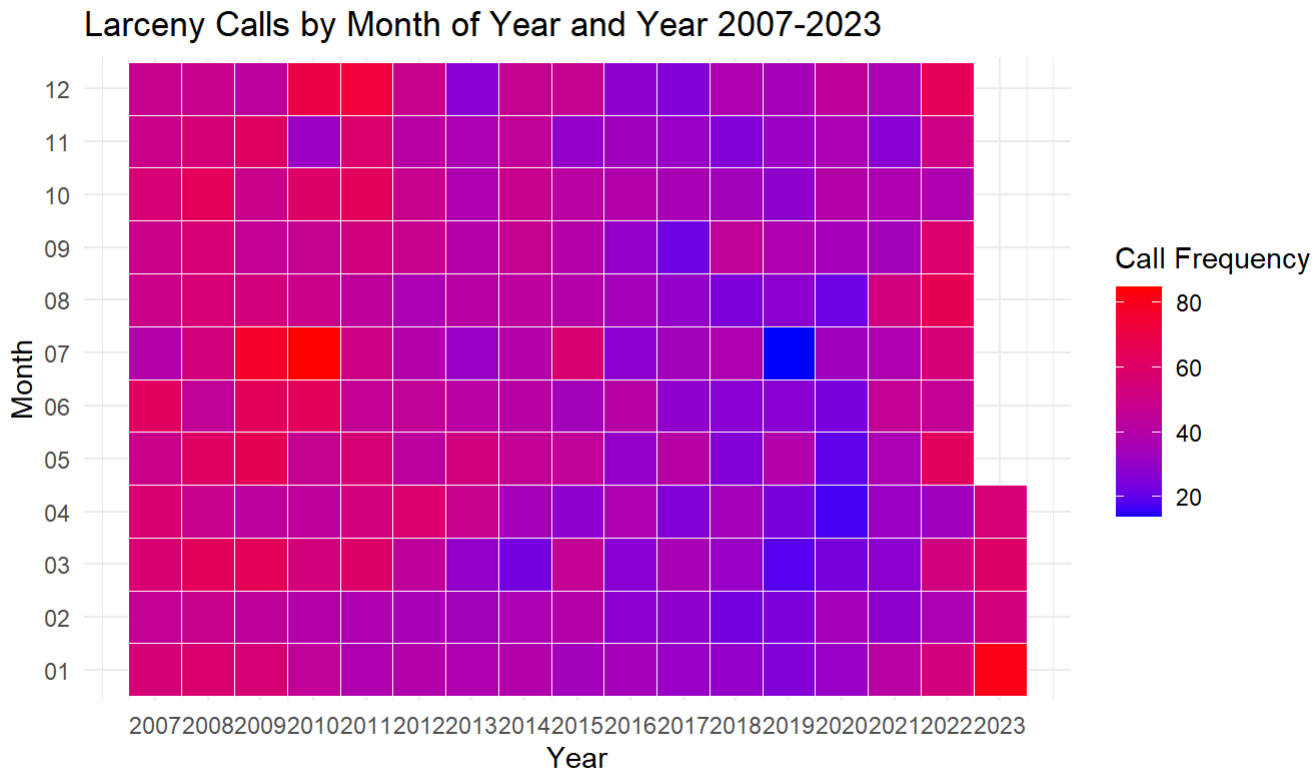


Larceny Calls by Month of Year 2007-2023




Larceny Calls by Day of Week and Hour of Day
Day of Week
Saturday
Friday
Thursday
Wednesday
Tuesday
Monday
Sunday
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour of Day
Call Frequency
125
100
75
50
25


Larceny Calls by Day of Month and Month of Year
Month
12
11
10
09
08
07
06
05
04
03
02
01
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month
Call Frequency
30
20
10



Analysis

From 2007-2023, there have been variations in the frequency of larceny calls by month each year. Overall, the number of larceny calls each month was higher from 2007-2011 with hotspots occurring in March, May, June, July, and December. Additionally, during this time, a coldspot occurred in February. In 2012, the number of calls for larceny began to steadily decline across all months until 2021 when they began to increase. From 2012-2020, hotspots varied by month with May, June, August, September, and December having the highest frequency of calls. Coldspots from 2012-2020 occurred during February, March, and April which had the lowest frequency of calls. There was an overall increase in calls across all months from 2021-2023. Hotspots occurred during January, May, and August, while coldspots occurred during February, June, October, and November. The frequency of calls for August stayed around the same from 2007-2011 before decreasing from 2012-2020 and then increasing from 2021-2022 to the highest frequency seen in August across all years. Since the frequency of calls for larceny during August increased in both 2021 and 2022, it can be expected that the number of calls will continue to increase in August 2023, slightly past the frequency of calls that occurred in August 2022. As August has also tended to have one of the highest frequency of calls across all months from 2012-2022, it will likely remain a hotspot in 2023.

Similar to the patterns seen for larceny calls by month, the frequency of larceny calls varies depending on the day of the week, as well as across the years 2007-2023. As stated above, the frequency of larceny calls was higher from 2007-2011 before decreasing from 2012-2020 and finally increasing from 2021-2023. During 2007-2011, hotspots occurred on Monday, Wednesday, and Thursday. Additionally, coldspots occurred on Saturday and Sunday. During 2012-2020, hotposts occurred on Monday, Tuesday, and Thursday. Coldspots during this time occurred on Saturday and Sunday, the same as for 2007-2011. From 2021-2023, hotspots occurred on Monday, Tuesday, Thursday, and Friday, while coldspots continued to occur on Saturday and Sunday. The frequency of larceny calls also varies by the day of the month across the different months of the year. In general, hotspots occur

during the middle of the month on days 13-20, as well as at the end of the month on days 28-31. Additionally, a coldspot occurs on days 23-26. Since the lowest frequency of calls has consistently occurred on Saturday and Sunday, it can be expected that there will be the fewest number of larceny calls next week on those two days. Additionally, it can be expected that most calls will occur on Monday and Thursday as those two days have consistently been hotspots throughout 2007-2023. Since next week consists of days 9-16 of the month, the frequency of calls may be higher than it was this week since days 13-16 tend to be a hotspot.

Across the course of the day, there are certain times when larceny calls are more likely to occur. The hours when larceny calls are most frequent and the hours when they are least have stayed relatively the same from 2007-2023, with no consistent patterns or trends across the week, month, or year. In general, the frequency of larceny calls is lowest and a coldspot during the beginning of the day (0-7:00) before steadily increasing to peak at 13:00, followed by steadily decreasing throughout the rest of the day. A hotspot occurs from 11:00-17:00 with 13:00 being the hour with the highest number of calls. Additionally, a coldspot occurs from 3:00-6:00 with 4:00 having the overall lowest number of calls. As this pattern has remained relatively the same both across and over time, it is likely to continue to do so.