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Experiment no 4

Aim :
Create basic charts using R programming language on dataset Crime or Police / Law and Order

- Basic - Bar chart, Pie chart, Histogram, Time line chart, Scatter plot, Bubble plot
- Write observations from each chart

Database:
https://www.kaggle.com/datasets/adoumtaiga/crime-data-set

R Script :-

```
install.packages("ggplot2") install.packages("dplyr")

library(ggplot2) library(dplyr)

# Check for missing values summary(Crime_Data)

Crime_Data$Occurred.Date <- as.Date(Crime_Data$Occurred.Date, format = "%m/%d/%Y")
Crime_Data$Reported.Date <- as.Date(Crime_Data$Reported.Date, format = "%m/%d/%Y")

# Bar Chart
```

```
# Summarize and sort the data to get the top 10 categories
top_10_crime <- Crime_Data %>%
group_by(Crime.Subcategory) %>%
summarise(Count = n()) %>%
arrange(desc(Count)) %>%
slice_head(n = 10)  # Select the top 10 categories

# Create a bar chart for the top 10 categories
ggplot(top_10_crime, aes(x = reorder(Crime.Subcategory, -Count), y = Count)) +
geom_bar(stat = "identity", fill = "skyblue") +    theme_minimal(base_size = 15) +
labs(title = "Top 10 Crime Subcategories", x = "Crime Subcategory", y = "Count") +
theme(axis.text.x = element_text(angle = 45, hjust = 1))  # Rotate x-axis labels for readability

#Pie Chart

# Create a frequency table for the Precinct column pie_data_precinct <-
table(Crime_Data$Precinct)

# Create a pie chart for Precincts
pie(pie_data_precinct,
    main = "Pie Chart of Precincts",
    col = rainbow(length(pie_data_precinct)))

# Optional: Add percentages to the pie chart for better clarity percent_labels <-
round(100 * pie_data_precinct / sum(pie_data_precinct), 1) labels <-
paste(names(pie_data_precinct), "(", percent_labels, "%)", sep="")
pie(pie_data_precinct, labels = labels, main = "Pie Chart of Precincts", col =
rainbow(length(pie_data_precinct)))

#Histogram

ggplot(Crime_Data, aes(x = Reported.Time)) +    geom_histogram(binwidth = 100, fill =
"orange", color = "black") +    theme_minimal() +    labs(title = "Distribution of Reported
Times", x = "Reported Time", y = "Frequency")

ggplot(Crime_Data, aes(x = Occurred.Time)) +    geom_histogram(binwidth = 100, fill =
"yellow", color = "black") +    theme_minimal() +    labs(title = "Distribution of Occurred
Times", x = "Occurred Time", y = "Frequency")


# Time-Line Chart

ggplot(Crime_Data, aes(x = Occurred.Date)) +
```

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geom_histogram(binwidth = 365, fill = "purple", color = "black") +
theme_minimal(base_size = 15) +  labs(title = "Timeline of Crime Occurrences", x =
"Occurred Date", y = "Count") +  scale_x_date(limits = as.Date(c("2006-01-01", "2020-
01-01")),
             date_breaks = "5 years",                date_labels = "%Y")  # Setting
breaks and labels on the x-axis


# Scatter PLot

# Filter data between 2006 and 2020 filtered_data <- Crime_Data %>%   filter(Occurred.Date >=
as.Date("2006-01-01") & Occurred.Date <= as.Date("2020-12-31"))

# Plot the filtered data
ggplot(filtered_data, aes(x = Occurred.Date, y = Reported.Date)) +
geom_point(color = "darkgreen") +    theme_minimal(base_size = 15) +
labs(title = "Scatter Plot of Occurred Date vs Reported Date (2006-2020)",         x
= "Occurred Date", y = "Reported Date")

# Bubble Plot

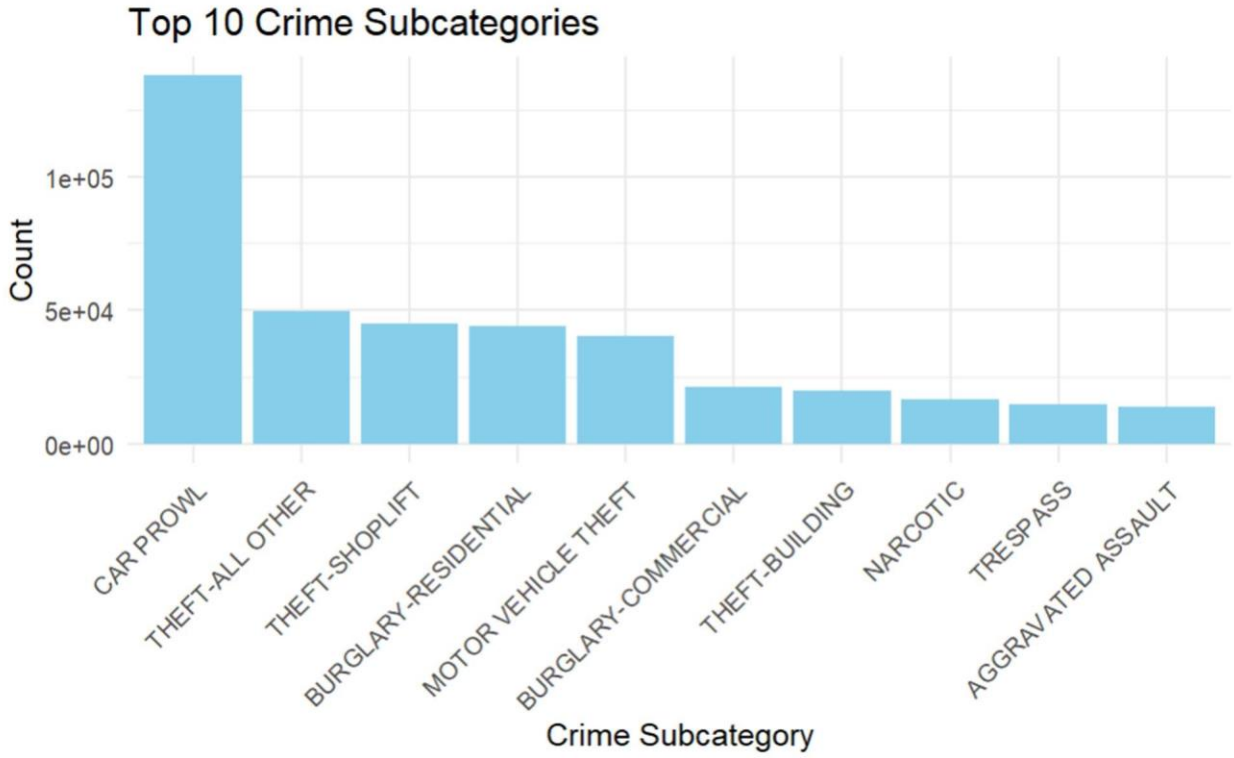
# Create a frequency table to count the number of occurrences for each crime subcategory
crime_count <- Crime_Data %>%   group_by(Crime.Subcategory) %>%   summarise(count = n())

# Join the frequency count back to the original data
Crime_Data          <-          Crime_Data          %>%
left_join(crime_count, by = "Crime.Subcategory")

# Plot the bubble plot with count as the size ggplot(Crime_Data, aes(x = Occurred.Date, y =
Reported.Date, size = count, color = Precinct))
+    geom_point(alpha = 0.6) +    theme_minimal(base_size = 15) +    labs(title =
"Bubble Plot of Occurred Date vs Reported Date",         x = "Occurred Date", y =
"Reported Date", size = "Crime Count") +    scale_size_continuous(range = c(3, 10))
# Adjust the size range for bubbles
```

Visualization -

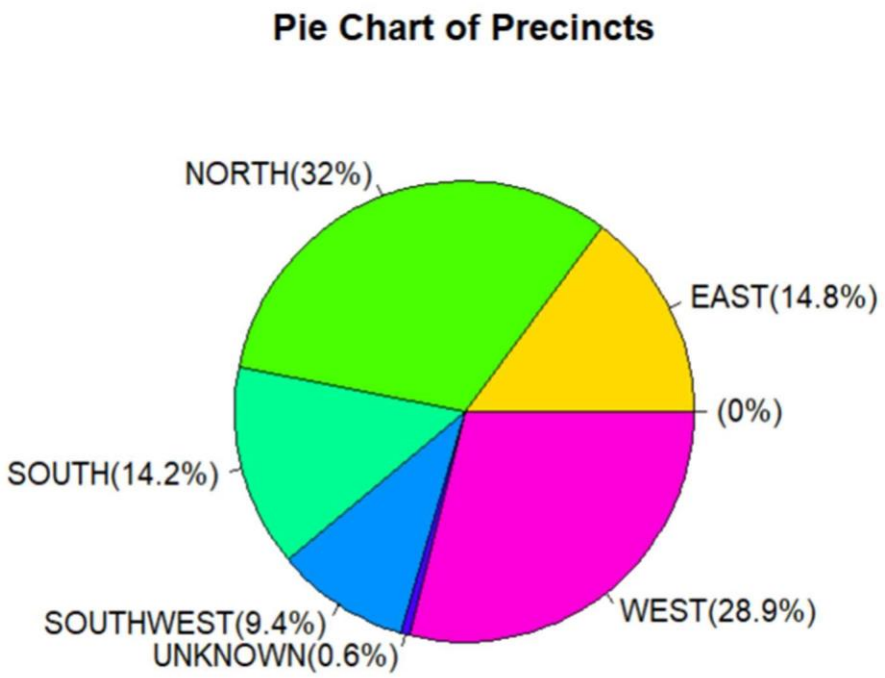
Bar Chart -



Observation :-

- Car prowl is by far the most common crime subcategory, with over 150,000 incidents recorded. This stands out significantly compared to other categories.
- The next four most common subcategories (theft-all other, theft-shoplift, burglary-residential, and motor vehicle theft) all have similar frequencies, ranging between approximately 40,000 to 50,000 incidents each.
- There's a noticeable drop in frequency after the top 5 categories. The remaining categories (burglary-commercial, theft-building, narcotic, trespass, and aggravated assault) have much lower incident counts.
- Property crimes dominate the top of the list. The top 7 categories all involve theft or burglary of some kind.
- Violent crime (aggravated assault) appears only at the bottom of this top 10 list, suggesting it's less frequent than property crimes in this dataset.
- Trespass and narcotic offenses are the only non-theft related crimes in the middle of the list.
- The distribution of crime types is quite uneven, with a large gap between the most common (car prowl) and the least common (aggravated assault) in this top 10 list.
- The y-axis scale suggests that even the least frequent crime in this top 10 list (aggravated assault) still occurs thousands of times.

Pie Chart -

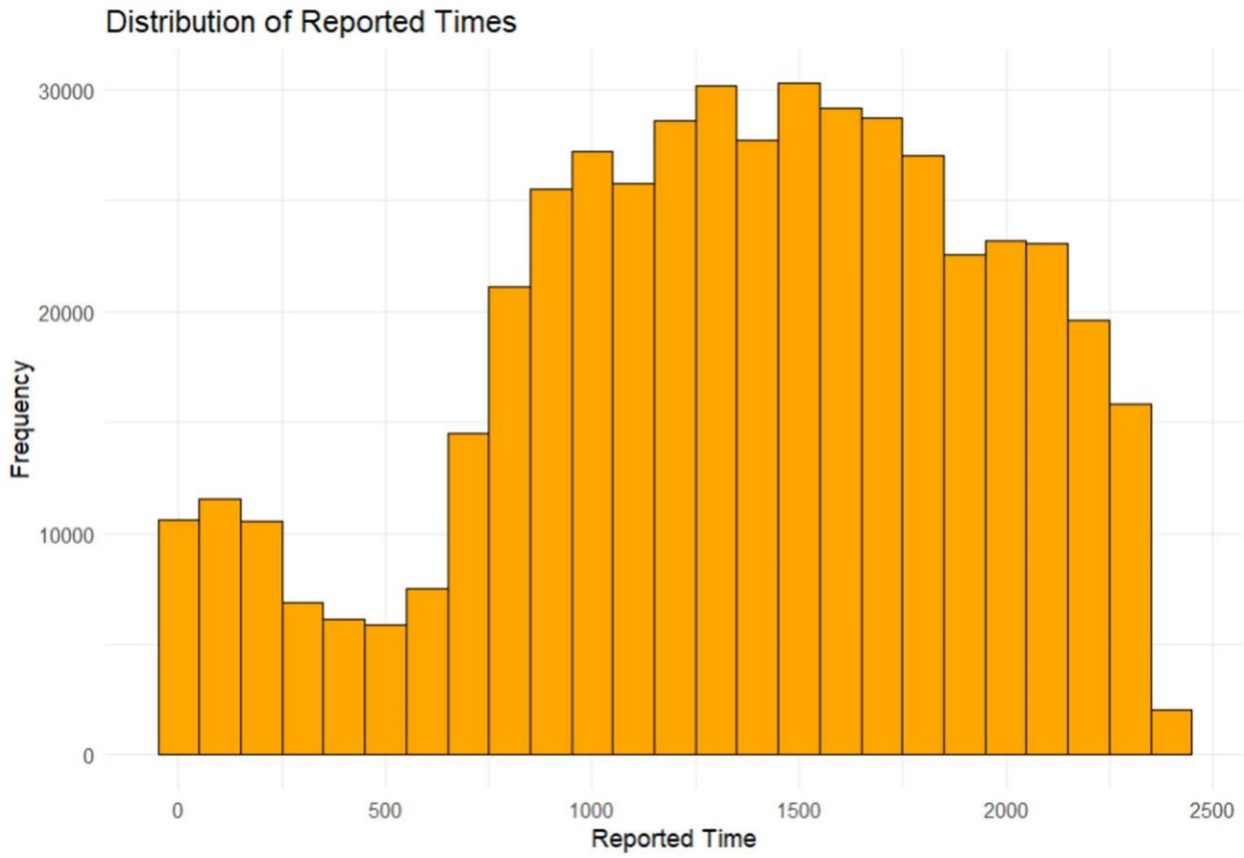


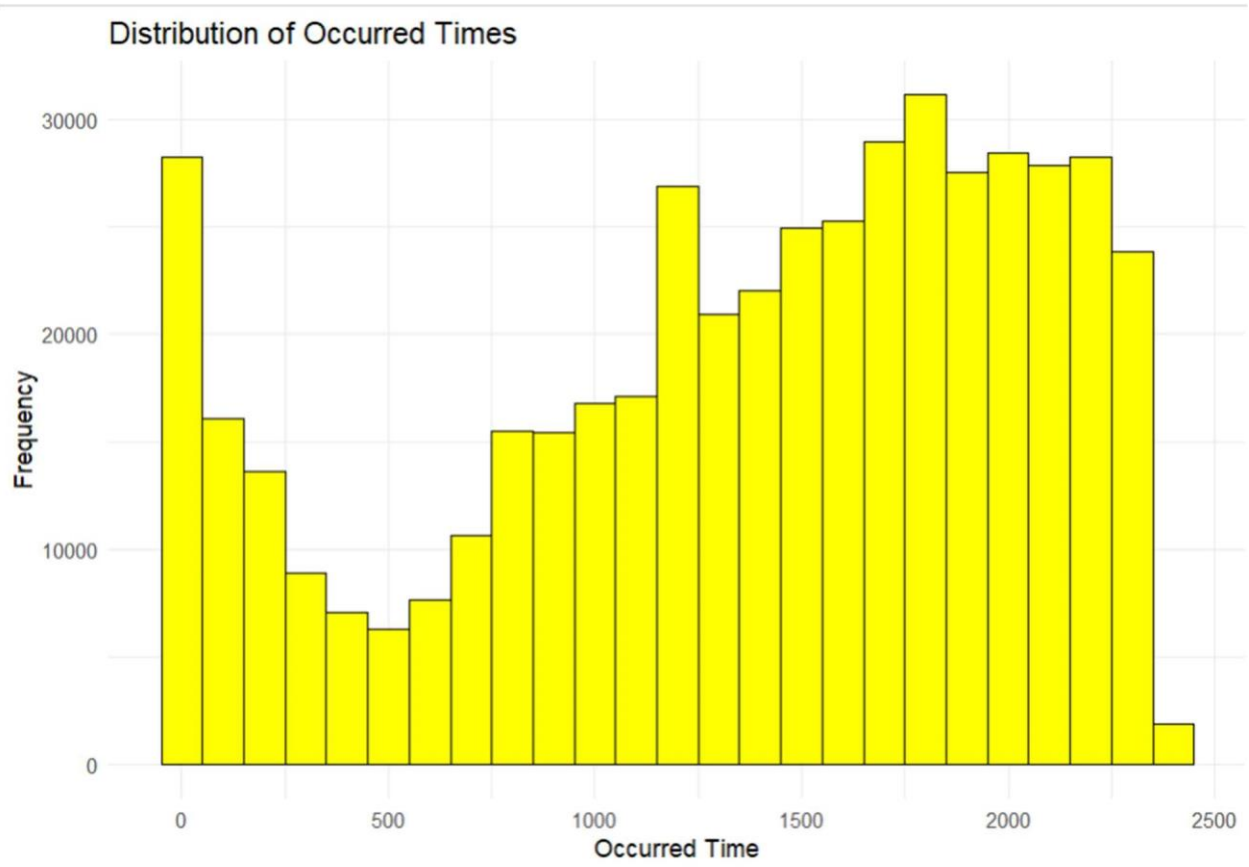
Observation :-

- Largest precinct: The North precinct accounts for the largest portion of the data, representing 32% of all incidents.
- Second largest: The West precinct is the second most represented, with 28.9% of incidents.
- Similar mid-range precincts: The East and South precincts have similar representations, with 14.8% and 14.2% respectively.
- Smaller precinct: The Southwest precinct accounts for a smaller portion, at 9.4% of incidents.
- Minimal unknown data: There's a very small percentage (0.6%) of incidents with an unknown precinct.
- Unexplained slice: There's a 0% slice in the chart, which may be a visualization error or represent an extremely small category.
- Coverage distribution: The North and West precincts combined account for over 60% of all incidents, suggesting a potentially higher concentration of reported crimes or policing activity in these areas.
- Geographic insights: Without knowing the exact geography, this distribution suggests that crime reports or police activity are not evenly spread across the city/region, with some areas seeing significantly more incidents than others.

- Data completeness: The very low percentage of unknown precincts (0.6%) indicates good data quality in terms of location recording.

Histogram -





Observation :-

Reported Times :

- The distribution is unimodal, peaking around 1500 (3:00 PM).
- There's a gradual increase from about 800 (8:00 AM) to the peak.
- After the peak, there's a gradual decline until about 2300 (11:00 PM).
- Very few crimes are reported between midnight and 6:00 AM.
- The distribution is roughly bell-shaped, suggesting most crime reports happen during daytime and early evening hours.

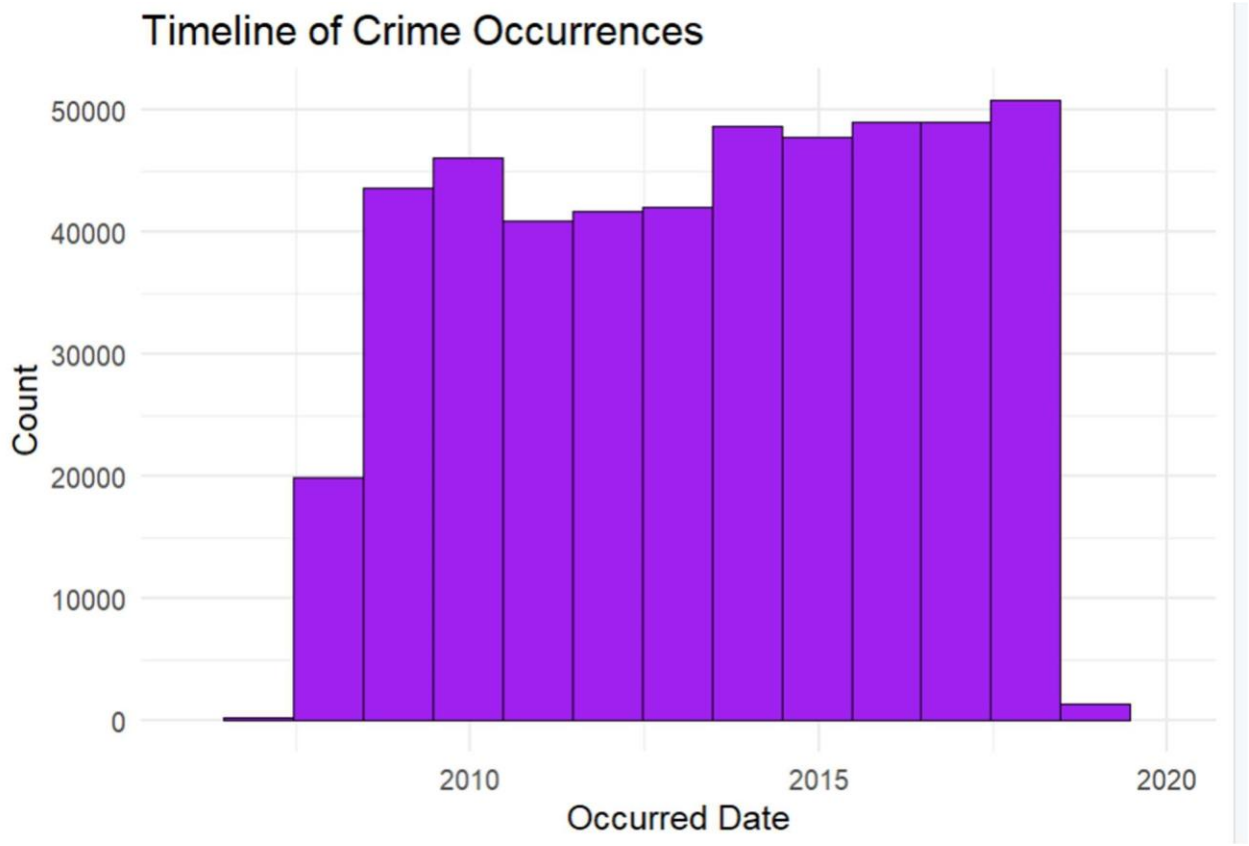
Occurred Times :

- This distribution is bimodal, with two distinct peaks.
- The first major peak is at 0 (midnight), suggesting many crimes occur or are discovered then.
- There's a second, smaller peak around 1800 (6:00 PM).
- The frequency is generally higher from noon to midnight compared to early morning hours.
- There's a noticeable dip in occurrences around 500-700 (5:00-7:00 AM).

Comparing the two:

- The occurred times show more variability and distinct patterns compared to reported times.
- There's a significant mismatch between when crimes occur (often at night) and when they're reported (mostly during the day).
- The high frequency of occurrences at midnight in Image 2 isn't reflected in the reported times, suggesting a delay in reporting.
- The daytime peak in reported crimes doesn't correspond to a similar peak in occurred crimes, indicating that many nighttime crimes are likely reported the next day.

Time Line -

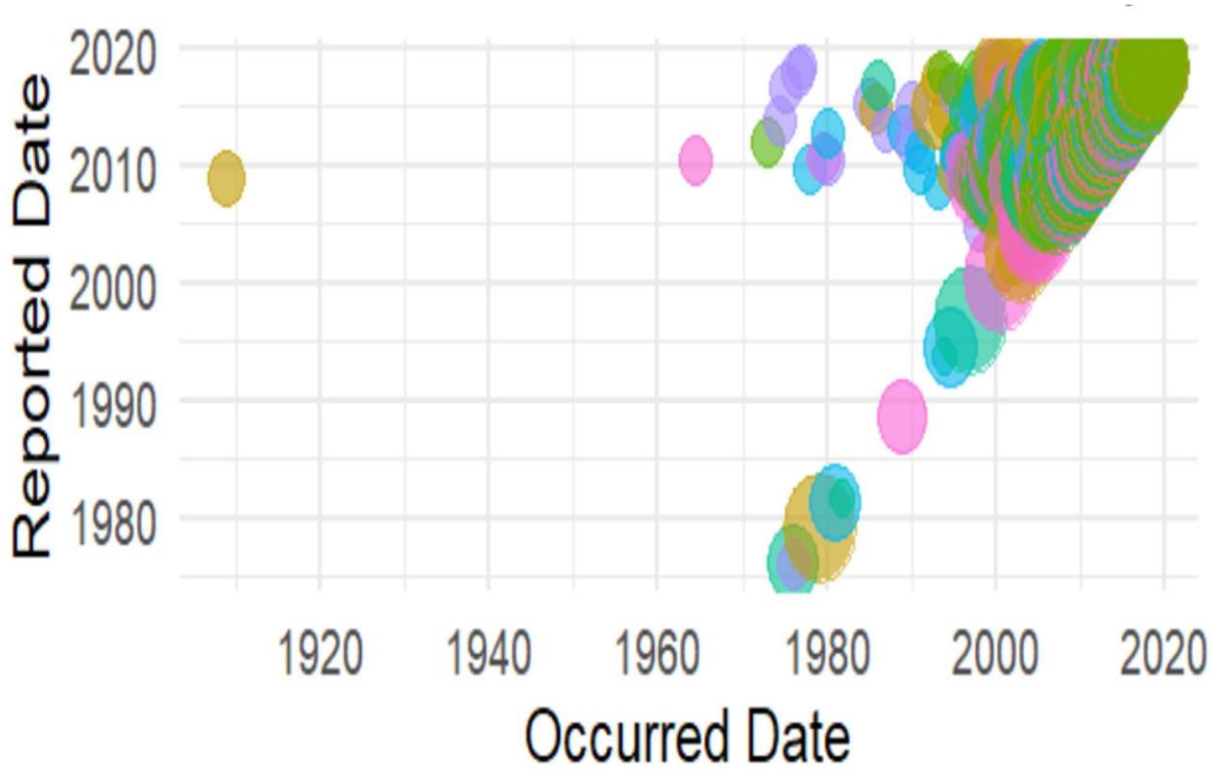


Observation :-

- Time range: The graph covers crime data from approximately 2008 to 2020.
- Overall trend: There's a general upward trend in crime occurrences over the years, with some fluctuations.
- Initial spike: There's a sharp increase in crime occurrences from 2008 to 2010, jumping from very low numbers to around 45,000 annually.
- Plateau and slight decline: From 2010 to 2013, there's a relatively stable period with a slight decline in crime occurrences.

- Steady increase: Starting from around 2013, there's a consistent upward trend in crime occurrences until 2019.
- Peak: The highest number of crime occurrences appears to be in 2019, reaching slightly over 50,000 incidents.
- Recent drop: There's a sharp decline in 2020, likely only representing partial data for that year or possibly influenced by external factors (e.g., COVID-19 pandemic).
  Data completeness: The very low numbers before 2008 suggest that the dataset might not have complete records for earlier years.
  Yearly variations: While there's an overall increasing trend, there are noticeable year-to-year variations throughout the timeline.
- Consistent reporting: The relatively smooth progression of the graph suggests consistent crime reporting practices over the years, with no major gaps or anomalies (except for the beginning and end of the timeline).

Bubble Plot -



Observation :-

- Wide time range: The plot covers a surprisingly large timespan, from around 1920 to 2020 for occurred dates, suggesting some very old cases are included.

- Diagonal concentration: The majority of data points fall along or near the diagonal line, indicating that most crimes are reported close to when they occurred.
- Vertical clusters: There are several distinct vertical clusters of points, particularly noticeable around 1980 and 2000 on the x-axis. This suggests batches of crimes being reported at the same time, possibly due to administrative processes or discovery of historical cases.
- Historical reporting: Some crimes that occurred decades ago (as far back as the 1920s) were reported much more recently, shown by points in the upper-left quadrant of the plot.
- Bubble size variation: The varying sizes of the bubbles indicate different frequencies of crime types, with larger bubbles representing more common crime subcategories.

  Color distribution: The mix of colors throughout the plot suggests that the patterns of crime occurrence and reporting are generally consistent across different precincts.

  Recent density: The density of points increases significantly for more recent years (post-2000), likely due to better record-keeping and more immediate reporting in recent times.

Conclusion :- From this experiment, I learned about R language and how to use r studio and how to import dataset and plot visualization in R studio.