IE 6400 FUNDAMENTALS OF DATA ANALYTICS (GROUP - 8)

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DATA AQUISITION :

```
#Initialzation
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from statsmodels.tsa.arima.model import ARIMA
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import LabelEncoder

crimeData = pd.read_csv('Crime_Data_from_2020_to_Present.csv')
```

DATA INSPECTION :

```
#Display the first few rows of the dataset.
crimeData.head(10)
```

```
       DR_NO               Date Rptd                 DATE OCC  TIME OCC
AREA  \
0  190326475  03/01/2020 12:00:00 AM  03/01/2020 12:00:00 AM      2130
7
1  200106753  02/09/2020 12:00:00 AM  02/08/2020 12:00:00 AM      1800
1
2  200320258  11/11/2020 12:00:00 AM  11/04/2020 12:00:00 AM      1700
3
3  200907217  05/10/2023 12:00:00 AM  03/10/2020 12:00:00 AM      2037
9
4  220614831  08/18/2022 12:00:00 AM  08/17/2020 12:00:00 AM      1200
6
5  231808869  04/04/2023 12:00:00 AM  12/01/2020 12:00:00 AM      2300
18
6  230110144  04/04/2023 12:00:00 AM  07/03/2020 12:00:00 AM       900
1
7  220314085  07/22/2022 12:00:00 AM  05/12/2020 12:00:00 AM      1110
3
8  231309864  04/28/2023 12:00:00 AM  12/09/2020 12:00:00 AM      1400
13
9  211904005  12/31/2020 12:00:00 AM  12/31/2020 12:00:00 AM      1220
19

   AREA NAME  Rpt Dist No  Part 1-2  Crm Cd  \
```

```
0   Wilshire          784         1     510
1    Central          182         1     330
2  Southwest          356         1     480
3   Van Nuys          964         1     343
4  Hollywood          666         2     354
5  Southeast         1826         2     354
6    Central          182         2     354
7  Southwest          303         2     354
8     Newton         1375         2     354
9    Mission         1974         2     624

                                Crm Cd Desc  ... Status   Status Desc
\
0                          VEHICLE - STOLEN  ...     AA  Adult Arrest

1                       BURGLARY FROM VEHICLE  ...     IC   Invest Cont

2                             BIKE - STOLEN  ...     IC   Invest Cont

3  SHOPLIFTING-GRAND THEFT ($950.01 & OVER)  ...     IC   Invest Cont

4                          THEFT OF IDENTITY  ...     IC   Invest Cont

5                          THEFT OF IDENTITY  ...     IC   Invest Cont

6                          THEFT OF IDENTITY  ...     IC   Invest Cont

7                          THEFT OF IDENTITY  ...     IC   Invest Cont

8                          THEFT OF IDENTITY  ...     IC   Invest Cont

9                    BATTERY - SIMPLE ASSAULT  ...     IC   Invest Cont


  Crm Cd 1 Crm Cd 2  Crm Cd 3 Crm Cd 4  \
0    510.0    998.0       NaN      NaN
1    330.0    998.0       NaN      NaN
2    480.0      NaN       NaN      NaN
3    343.0      NaN       NaN      NaN
4    354.0      NaN       NaN      NaN
5    354.0      NaN       NaN      NaN
6    354.0      NaN       NaN      NaN
7    354.0      NaN       NaN      NaN
8    354.0      NaN       NaN      NaN
9    624.0      NaN       NaN      NaN

                                    LOCATION Cross Street      LAT
LON
0   1900 S  LONGWOOD                     AV          NaN  34.0375 -
118.3506
```

```
1   1000 S  FLOWER                         ST          NaN  34.0444 -
118.2628
2   1400 W  37TH                           ST          NaN  34.0210 -
118.3002
3  14000    RIVERSIDE                      DR          NaN  34.1576 -
118.4387
4                        1900    TRANSIENT          NaN  34.0944 -
118.3277
5   9900    COMPTON                        AV          NaN  33.9467 -
118.2463
6   1100 S  GRAND                          AV          NaN  34.0415 -
118.2620
7   2500 S  SYCAMORE                       AV          NaN  34.0335 -
118.3537
8   1300 E  57TH                           ST          NaN  33.9911 -
118.2521
9   9000    CEDROS                         AV          NaN  34.2336 -
118.4535

[10 rows x 28 columns]
```

```
#Check the data types of each column.
print("Datatypes of each column: ")
crimeData.dtypes
```

```
Datatypes of each column:

DR_NO               int64
Date Rptd          object
DATE OCC           object
TIME OCC            int64
AREA                int64
AREA NAME          object
Rpt Dist No         int64
Part 1-2            int64
Crm Cd              int64
Crm Cd Desc        object
Mocodes            object
Vict Age            int64
Vict Sex           object
Vict Descent       object
Premis Cd         float64
Premis Desc        object
Weapon Used Cd    float64
Weapon Desc        object
Status             object
Status Desc        object
Crm Cd 1          float64
Crm Cd 2          float64
Crm Cd 3          float64
```

```
Crm Cd 4          float64
LOCATION           object
Cross Street       object
LAT               float64
LON               float64
dtype: object
```

```
#Review column names and descriptions, if available.
print("Columns: ")
for column in crimeData.columns:
    null_count = crimeData[column].isnull().sum()
    print(f"Column '{column}' has {null_count} null values.")

print("Description: ")
crimeData.describe()
```

```
Columns:
Column 'DR_NO' has 0 null values.
Column 'Date Rptd' has 0 null values.
Column 'DATE OCC' has 0 null values.
Column 'TIME OCC' has 0 null values.
Column 'AREA' has 0 null values.
Column 'AREA NAME' has 0 null values.
Column 'Rpt Dist No' has 0 null values.
Column 'Part 1-2' has 0 null values.
Column 'Crm Cd' has 0 null values.
Column 'Crm Cd Desc' has 0 null values.
Column 'Mocodes' has 145262 null values.
Column 'Vict Age' has 0 null values.
Column 'Vict Sex' has 138445 null values.
Column 'Vict Descent' has 138456 null values.
Column 'Premis Cd' has 14 null values.
Column 'Premis Desc' has 585 null values.
Column 'Weapon Used Cd' has 656471 null values.
Column 'Weapon Desc' has 656471 null values.
Column 'Status' has 1 null values.
Column 'Status Desc' has 0 null values.
Column 'Crm Cd 1' has 11 null values.
Column 'Crm Cd 2' has 913763 null values.
Column 'Crm Cd 3' has 980327 null values.
Column 'Crm Cd 4' has 982574 null values.
Column 'LOCATION' has 0 null values.
Column 'Cross Street' has 830789 null values.
Column 'LAT' has 0 null values.
Column 'LON' has 0 null values.
Description:
```

```
              DR_NO       TIME OCC           AREA    Rpt Dist No  \
count  9.826380e+05  982638.000000  982638.000000  982638.000000
mean   2.197437e+08    1338.945426      10.700277    1116.459887
```

```
std    1.294954e+07     651.537830       6.107808     610.893787
min    8.170000e+02       1.000000       1.000000     101.000000
25%    2.106089e+08     900.000000       5.000000     587.000000
50%    2.208146e+08    1420.000000      11.000000    1141.000000
75%    2.309153e+08    1900.000000      16.000000    1617.000000
max    2.499253e+08    2359.000000      21.000000    2199.000000

            Part 1-2         Crm Cd       Vict Age      Premis Cd  \
count  982638.000000  982638.000000  982638.000000  982624.000000
mean        1.404253     500.823555      29.079817     306.133008
std         0.490747     206.211940      21.970094     219.053795
min         1.000000     110.000000      -4.000000     101.000000
25%         1.000000     331.000000       0.000000     101.000000
50%         1.000000     442.000000      30.000000     203.000000
75%         2.000000     626.000000      44.000000     501.000000
max         2.000000     956.000000     120.000000     976.000000

       Weapon Used Cd       Crm Cd 1      Crm Cd 2     Crm Cd 3   Crm
Cd 4  \
count   326167.000000  982627.000000  68875.000000  2311.000000
64.00000
mean       363.840882     500.578668    958.167085   984.204673
991.21875
std        123.684663     206.010361    110.232109    51.485644
27.06985
min        101.000000     110.000000    210.000000   310.000000
821.00000
25%        311.000000     331.000000    998.000000   998.000000
998.00000
50%        400.000000     442.000000    998.000000   998.000000
998.00000
75%        400.000000     626.000000    998.000000   998.000000
998.00000
max        516.000000     956.000000    999.000000   999.000000
999.00000

                 LAT            LON
count  982638.000000  982638.000000
mean       33.995725    -118.082225
std         1.636729       5.672940
min         0.000000    -118.667600
25%        34.014600    -118.430500
50%        34.058900    -118.322500
75%        34.164900    -118.273900
max        34.334300       0.000000
```

DATA CLEANING :

```
#Identify and handle missing data appropriately.
print("Null Value existance: ", crimeData.isnull())
print("Total number of null value count in the dataframe:
",crimeData.isnull().sum().sum())
filledData = crimeData.fillna(value = "NA")
print("Null values filled dataframe: ", filledData)
```

```
Null Value existance:          DR_NO  Date Rptd  DATE OCC  TIME OCC
AREA  AREA NAME  Rpt Dist No  \
0       False      False     False     False  False      False
False
1       False      False     False     False  False      False
False
2       False      False     False     False  False      False
False
3       False      False     False     False  False      False
False
4       False      False     False     False  False      False
False
...       ...        ...       ...       ...    ...        ...
...
982633  False      False     False     False  False      False
False
982634  False      False     False     False  False      False
False
982635  False      False     False     False  False      False
False
982636  False      False     False     False  False      False
False
982637  False      False     False     False  False      False
False

        Part 1-2  Crm Cd  Crm Cd Desc  ...  Status  Status Desc  Crm
Cd 1  \
0          False   False        False  ...   False        False
False
1          False   False        False  ...   False        False
False
2          False   False        False  ...   False        False
False
3          False   False        False  ...   False        False
False
4          False   False        False  ...   False        False
False
...          ...     ...          ...  ...     ...          ...
...
982633     False   False        False  ...   False        False
False
982634     False   False        False  ...   False        False
False
```

```
982635     False   False        False  ...   False        False
False
982636     False   False        False  ...   False        False
False
982637     False   False        False  ...   False        False
False

        Crm Cd 2  Crm Cd 3  Crm Cd 4  LOCATION  Cross Street    LAT
LON
0          False      True      True     False          True  False
False
1          False      True      True     False          True  False
False
2           True      True      True     False          True  False
False
3           True      True      True     False          True  False
False
4           True      True      True     False          True  False
False
...          ...       ...       ...       ...           ...    ...
...
982633      True      True      True     False          True  False
False
982634      True      True      True     False          True  False
False
982635      True      True      True     False          True  False
False
982636      True      True      True     False         False  False
False
982637      True      True      True     False          True  False
False

[982638 rows x 28 columns]
Total number of null value count in the dataframe:  5443169
Null values filled dataframe:              DR_NO               Date
Rptd                DATE OCC  TIME OCC  \
0       190326475  03/01/2020 12:00:00 AM  03/01/2020 12:00:00 AM
2130
1       200106753  02/09/2020 12:00:00 AM  02/08/2020 12:00:00 AM
1800
2       200320258  11/11/2020 12:00:00 AM  11/04/2020 12:00:00 AM
1700
3       200907217  05/10/2023 12:00:00 AM  03/10/2020 12:00:00 AM
2037
4       220614831  08/18/2022 12:00:00 AM  08/17/2020 12:00:00 AM
1200
...           ...                     ...                     ...
...
982633  242011172  08/20/2024 12:00:00 AM  08/17/2024 12:00:00 AM
```

```
2300
982634  240710284  07/24/2024 12:00:00 AM  07/23/2024 12:00:00 AM
1400
982635  240104953  01/15/2024 12:00:00 AM  01/15/2024 12:00:00 AM
100
982636  240309674  04/24/2024 12:00:00 AM  04/24/2024 12:00:00 AM
1500
982637  240910892  08/13/2024 12:00:00 AM  08/12/2024 12:00:00 AM
2300

        AREA  AREA NAME  Rpt Dist No  Part 1-2  Crm Cd  \
0          7   Wilshire          784         1     510
1          1    Central          182         1     330
2          3  Southwest          356         1     480
3          9   Van Nuys          964         1     343
4          6  Hollywood          666         2     354
...      ...        ...          ...       ...     ...
982633    20    Olympic         2033         1     341
982634     7   Wilshire          788         1     510
982635     1    Central          101         2     745
982636     3  Southwest          358         1     230
982637     9   Van Nuys          914         1     510

                                           Crm Cd Desc  ... Status
\
0                                   VEHICLE - STOLEN  ...     AA

1                                BURGLARY FROM VEHICLE  ...     IC

2                                   BIKE - STOLEN  ...     IC

3               SHOPLIFTING-GRAND THEFT ($950.01 & OVER)  ...     IC

4                                 THEFT OF IDENTITY  ...     IC

...                                                 ...  ...    ...

982633  THEFT-GRAND ($950.01 & OVER)EXCPT,GUNS,FOWL,LI...  ...     IC

982634                                   VEHICLE - STOLEN  ...     IC

982635           VANDALISM - MISDEAMEANOR ($399 OR UNDER)  ...     IC

982636     ASSAULT WITH DEADLY WEAPON, AGGRAVATED ASSAULT  ...     IC

982637                                   VEHICLE - STOLEN  ...     IC


        Status Desc Crm Cd 1 Crm Cd 2 Crm Cd 3 Crm Cd 4  \
0       Adult Arrest    510.0    998.0       NA       NA
1        Invest Cont    330.0    998.0       NA       NA
```

```
2         Invest Cont    480.0        NA        NA        NA
3         Invest Cont    343.0        NA        NA        NA
4         Invest Cont    354.0        NA        NA        NA
...              ...      ...       ...       ...       ...
982633    Invest Cont    341.0        NA        NA        NA
982634    Invest Cont    510.0        NA        NA        NA
982635    Invest Cont    745.0        NA        NA        NA
982636    Invest Cont    230.0        NA        NA        NA
982637    Invest Cont    510.0        NA        NA        NA

                                          LOCATION  \
0         1900 S  LONGWOOD                    AV
1         1000 S  FLOWER                      ST
2         1400 W  37TH                        ST
3        14000    RIVERSIDE                   DR
4                              1900    TRANSIENT
...                                         ...
982633    3700    WILSHIRE                    BL
982634    4000 W  23RD                        ST
982635    1300 W  SUNSET                      BL
982636            FLOWER                      ST
982637    6900    VESPER                      AV

                            Cross Street      LAT       LON
0                                     NA  34.0375 -118.3506
1                                     NA  34.0444 -118.2628
2                                     NA  34.0210 -118.3002
3                                     NA  34.1576 -118.4387
4                                     NA  34.0944 -118.3277
...                                  ...      ...       ...
982633                                NA  34.0617 -118.3066
982634                                NA  34.0362 -118.3284
982635                                NA  34.0685 -118.2460
982636  JEFFERSON                     BL  34.0215 -118.2868
982637                                NA  34.1961 -118.4510

[982638 rows x 28 columns]
```

```
#Check for and remove duplicate rows.
duplicateRows = crimeData[crimeData.duplicated()]
if not duplicateRows.empty:
    print("Duplicate Rows:")
    print(duplicateRows)
else:
    print("No duplicate rows available.")
```

```
No duplicate rows available.
```

```
#Convert data types if needed (e.g., dates to date format, numerical
values to appropriate numeric types).
```

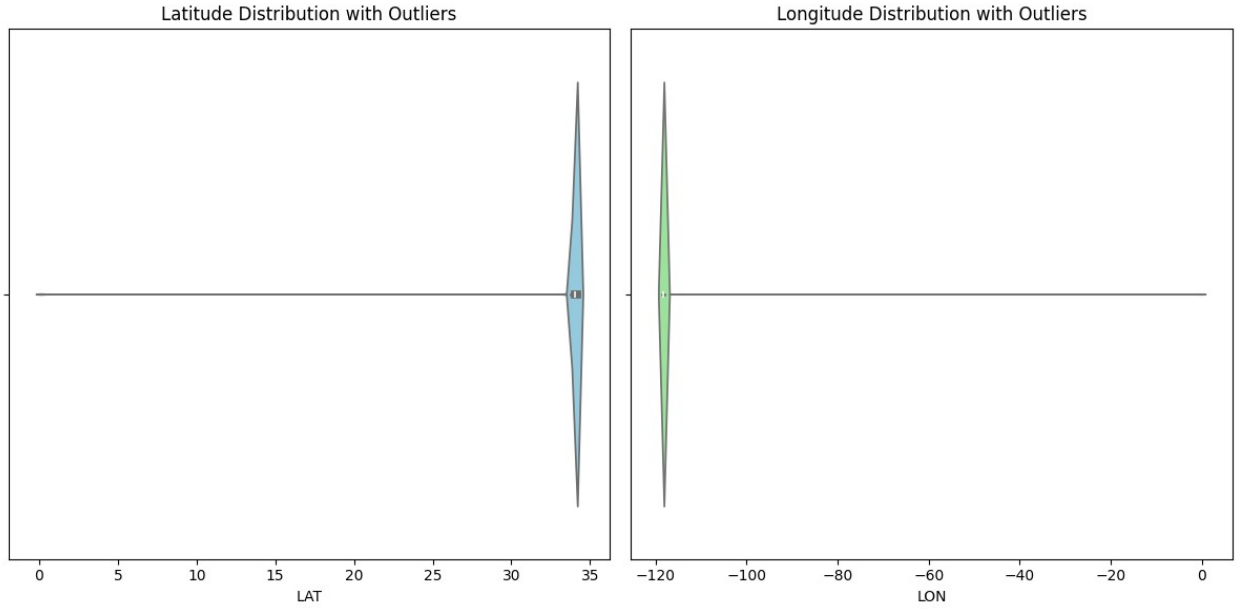
```
crimeData['Date Rptd'] = pd.to_datetime(crimeData['Date Rptd'],
format='%m/%d/%Y', errors='coerce')
crimeData['DATE OCC'] = pd.to_datetime(crimeData['DATE OCC'],
format='%m/%d/%Y', errors='coerce')
crimeData['TIME OCC'] = crimeData['TIME OCC'].fillna(0).astype(int)

print("CrimeData Datatypes: ")
print(crimeData.dtypes)
```

```
CrimeData Datatypes:
DR_NO                    int64
Date Rptd         datetime64[ns]
DATE OCC          datetime64[ns]
TIME OCC                 int64
AREA                     int64
AREA NAME               object
Rpt Dist No              int64
Part 1-2                 int64
Crm Cd                   int64
Crm Cd Desc             object
Mocodes                 object
Vict Age                 int64
Vict Sex                object
Vict Descent            object
Premis Cd              float64
Premis Desc             object
Weapon Used Cd         float64
Weapon Desc             object
Status                  object
Status Desc             object
Crm Cd 1               float64
Crm Cd 2               float64
Crm Cd 3               float64
Crm Cd 4               float64
LOCATION                object
Cross Street            object
LAT                    float64
LON                    float64
dtype: object
```

```
#Deal with outliers if relevant to your analysis.
Q1 = crimeData[['LAT', 'LON']].quantile(0.25)
Q3 = crimeData[['LAT', 'LON']].quantile(0.75)
IQR = Q3 - Q1

crime_data_no_outliers = crimeData[~((crimeData[['LAT', 'LON']] < (Q1
- 1.5 * IQR)) |
                                     (crimeData[['LAT', 'LON']] > (Q3
+ 1.5 * IQR))).any(axis=1)]
```

```
print(f"Original Data Shape: {crimeData.shape}")
print(f"Data Shape after Removing Outliers:
{crime_data_no_outliers.shape}")
plt.figure(figsize=(12, 6))

plt.subplot(1, 2, 1)
sns.violinplot(x=crimeData['LAT'], color='skyblue')
plt.title('Latitude Distribution with Outliers')

plt.subplot(1, 2, 2)
sns.violinplot(x=crimeData['LON'], color='lightgreen')
plt.title('Longitude Distribution with Outliers')

plt.tight_layout()
plt.show()
```

```
Original Data Shape: (982638, 28)
Data Shape after Removing Outliers: (952352, 28)
```




```
#Standardize or normalize numerical data as necessary.
numeric_columns = ['Vict Age', 'TIME OCC']

scaler = StandardScaler()
numeric_columns = ['Vict Age', 'TIME OCC']

crime_data_no_outliers.loc[:, numeric_columns] =
scaler.fit_transform(crime_data_no_outliers[numeric_columns])

print(crime_data_no_outliers[numeric_columns].head())
```

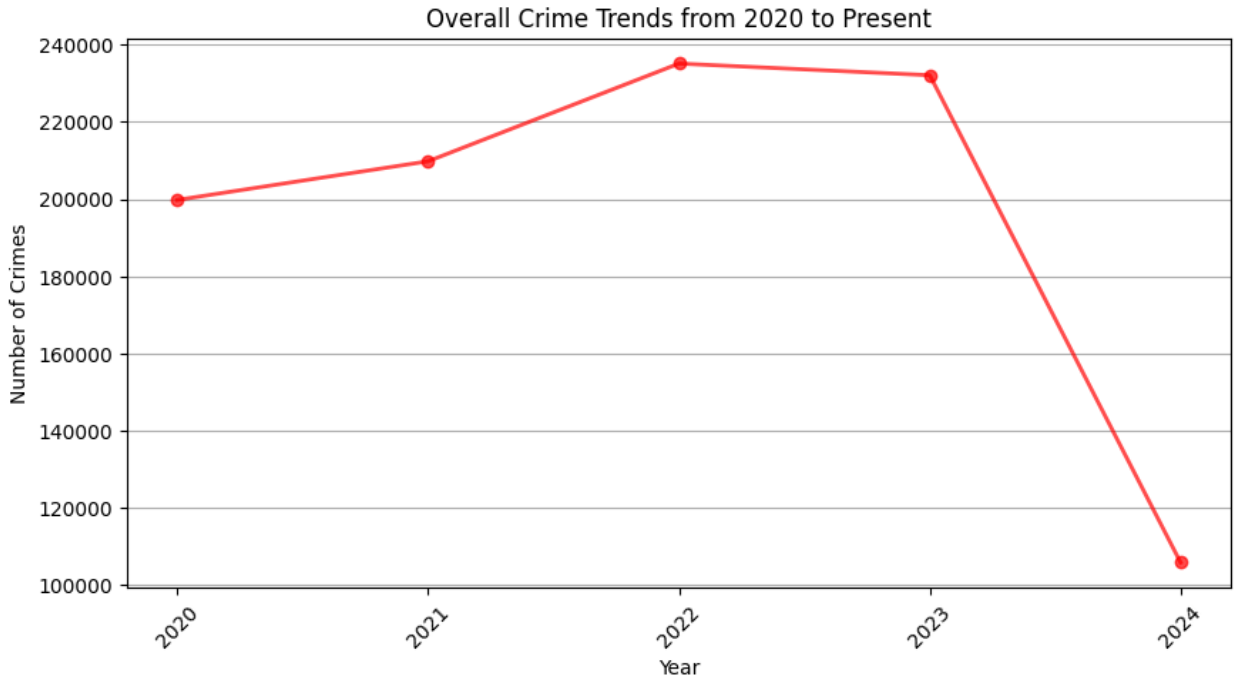
```
   Vict Age  TIME OCC
0 -1.326400  1.214413
1  0.816440  0.707789
2 -0.460146  0.554267
3 -0.460146  1.071637
4 -0.049815 -0.213345
```

```
#Encode categorical data if present.
label_encoder = LabelEncoder()

crimeData['Vict Descent Encoded'] =
label_encoder.fit_transform(crimeData['Vict Descent'])

print(crimeData[['Vict Descent', 'Vict Descent Encoded']].head())
```

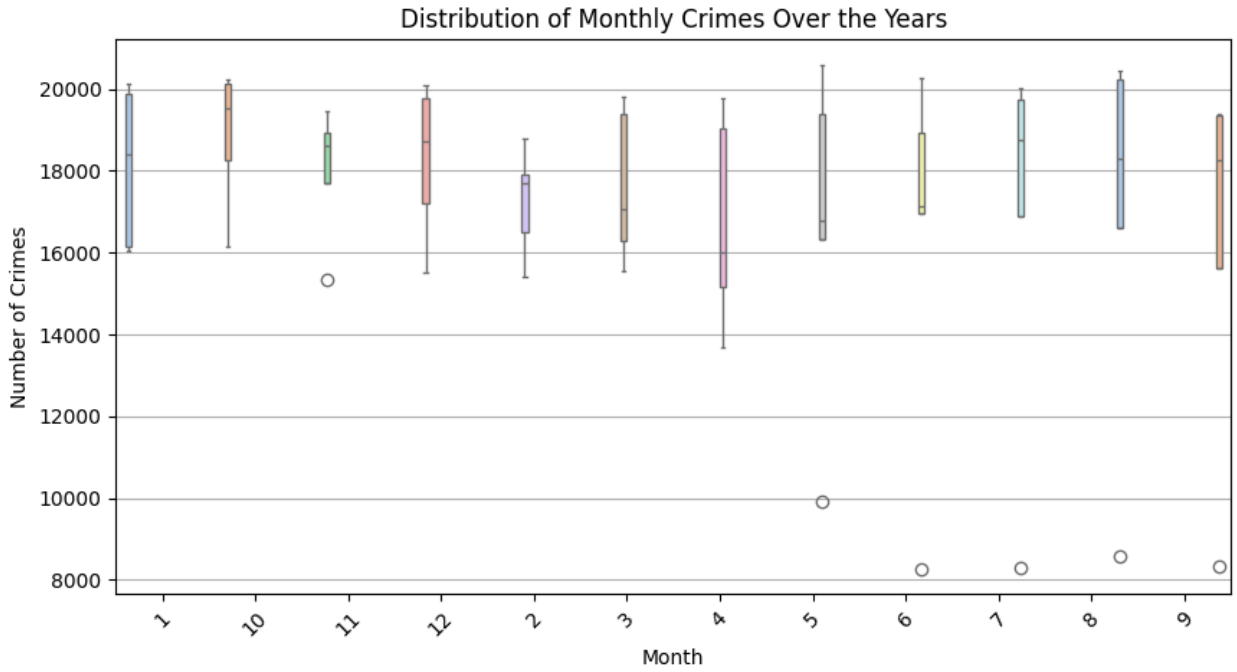
```
  Vict Descent  Vict Descent Encoded
0            O                    12
1            O                    12
2            X                    18
3            O                    12
4            H                     7
```

EXPLORATORY DATA ANALYSIS (EDA) :

```
#Visualize overall crime trends from 2020 to the present year.
date_format = "%Y-%m-%d"

crimeData['DATE OCC'] = pd.to_datetime(crimeData['DATE OCC'],
format=date_format, errors='coerce')

crimeData = crimeData[crimeData['DATE OCC'].dt.year >= 2020]

crimeData['year'] = crimeData['DATE OCC'].dt.year

crime_counts = crimeData['year'].value_counts().sort_index()

plt.figure(figsize=(10, 5))
plt.plot(crime_counts.index, crime_counts.values, marker='o',
color='red', alpha=0.7, linewidth=2)
plt.title('Overall Crime Trends from 2020 to Present')
plt.xlabel('Year')
plt.ylabel('Number of Crimes')
plt.xticks(crime_counts.index)
plt.grid(axis='y')
plt.xticks(crime_counts.index, rotation=45)
plt.show()
```



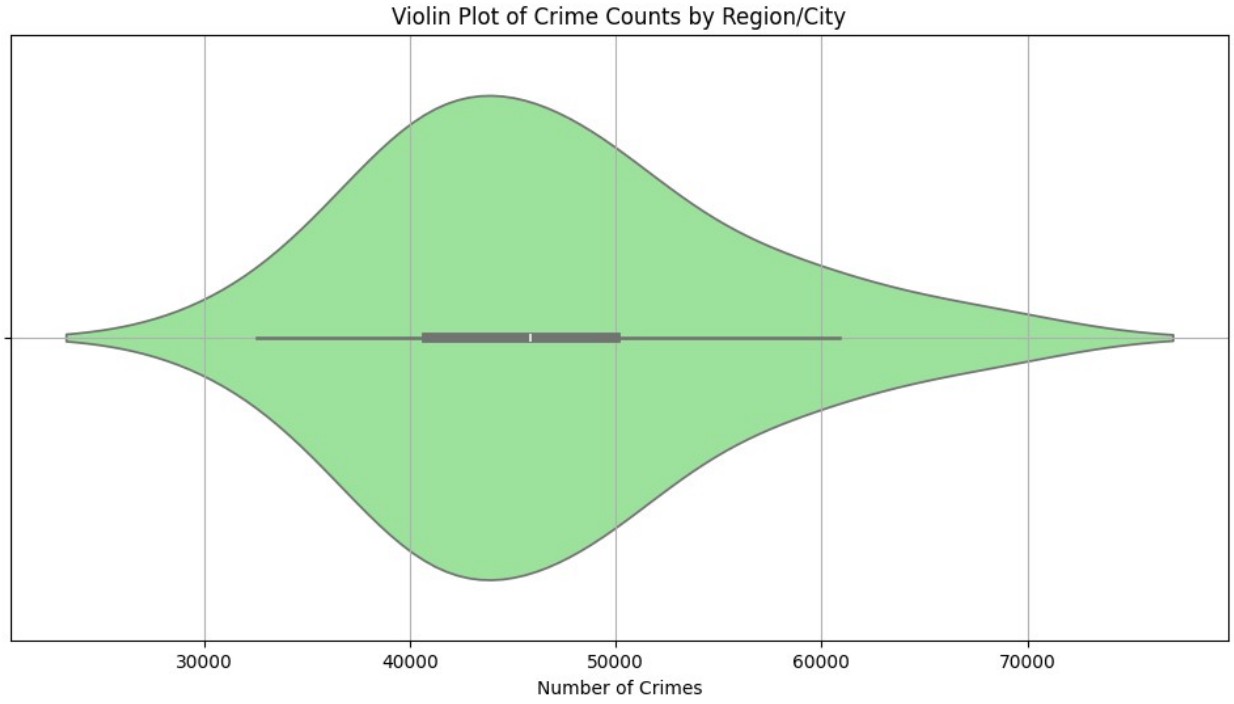

```
#Analyze and visualize seasonal patterns in crime data.
crimeData['Date Rptd'] = pd.to_datetime(crimeData['Date Rptd'],
format=date_format, errors='coerce')

crimeData['year'] = crimeData['Date Rptd'].dt.year
crimeData['month'] = crimeData['Date Rptd'].dt.month.astype(str)

monthly_crimes = crimeData.groupby(['year',
'month']).size().reset_index(name='crime_count')

plt.figure(figsize=(10, 5))
sns.boxplot(x='month', y='crime_count', data=monthly_crimes,
hue='month', palette='pastel', dodge=True, legend=False)
plt.title('Distribution of Monthly Crimes Over the Years')
plt.xlabel('Month')
plt.ylabel('Number of Crimes')
plt.xticks(rotation=45)
plt.grid(axis='y')
plt.show()
```




```
#Identify the most common type of crime and its trends over time.
crime_counts = crimeData['Crm Cd Desc'].value_counts()
most_common_crime = crime_counts.idxmax()
highest_frequency = crime_counts.max()
print(f"The most common crime type is '{most_common_crime}' with
{highest_frequency} occurrences.")
```

```
The most common crime type is 'VEHICLE - STOLEN' with 110804
occurrences.
```

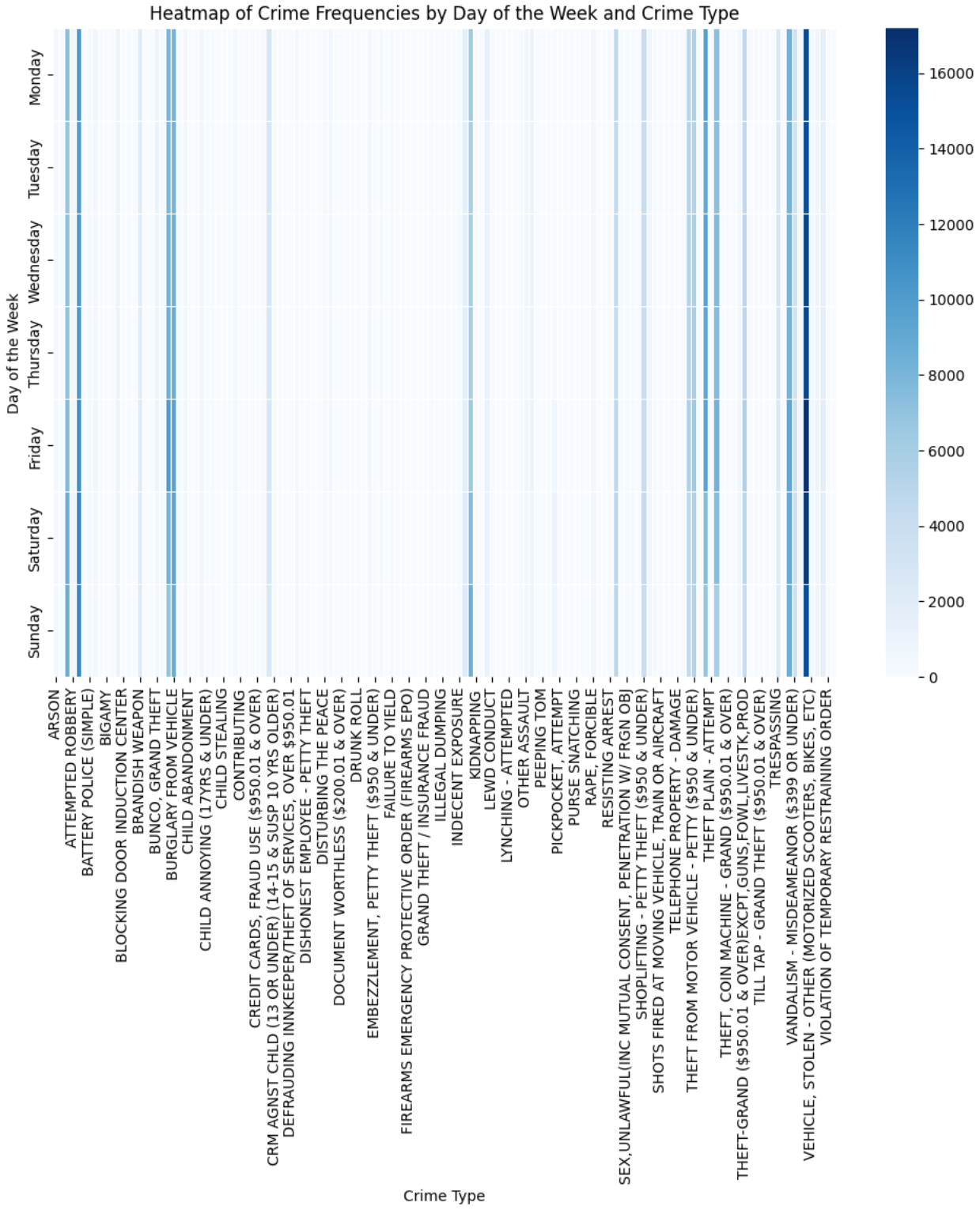
```
#nvestigate if there are any notable differences in crime rates
between regions or cities.
crime_by_region = crimeData['AREA NAME'].value_counts().reset_index()
crime_by_region.columns = ['Region/City', 'Crime Count']
plt.figure(figsize=(12, 6))
sns.violinplot(data=crime_by_region, x='Crime Count',
color='lightgreen')
plt.title('Violin Plot of Crime Counts by Region/City')
plt.xlabel('Number of Crimes')
plt.grid(True)
plt.show()
```




```
#Explore correlations between economic factors (if available) and
crime rates.
crimeData.info()
print("Looking at the dataset that has been provided,
Crime_Data_from_2020_to_Present.csv, it does not contain the required
column. Hence, a correlation cannot be found.")
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 982638 entries, 0 to 982637
Data columns (total 30 columns):
 #   Column          Non-Null Count   Dtype
---  ------          --------------   -----
 0   DR_NO           982638 non-null  int64
 1   Date Rptd       982638 non-null  datetime64[ns]
 2   DATE OCC        982638 non-null  datetime64[ns]
 3   TIME OCC        982638 non-null  int64
 4   AREA            982638 non-null  int64
 5   AREA NAME       982638 non-null  object
 6   Rpt Dist No     982638 non-null  int64
 7   Part 1-2        982638 non-null  int64
 8   Crm Cd          982638 non-null  int64
 9   Crm Cd Desc     982638 non-null  object
 10  Mocodes         837376 non-null  object
 11  Vict Age        982638 non-null  int64
 12  Vict Sex        844193 non-null  object
 13  Vict Descent    844182 non-null  object
 14  Premis Cd       982624 non-null  float64
 15  Premis Desc     982053 non-null  object
```

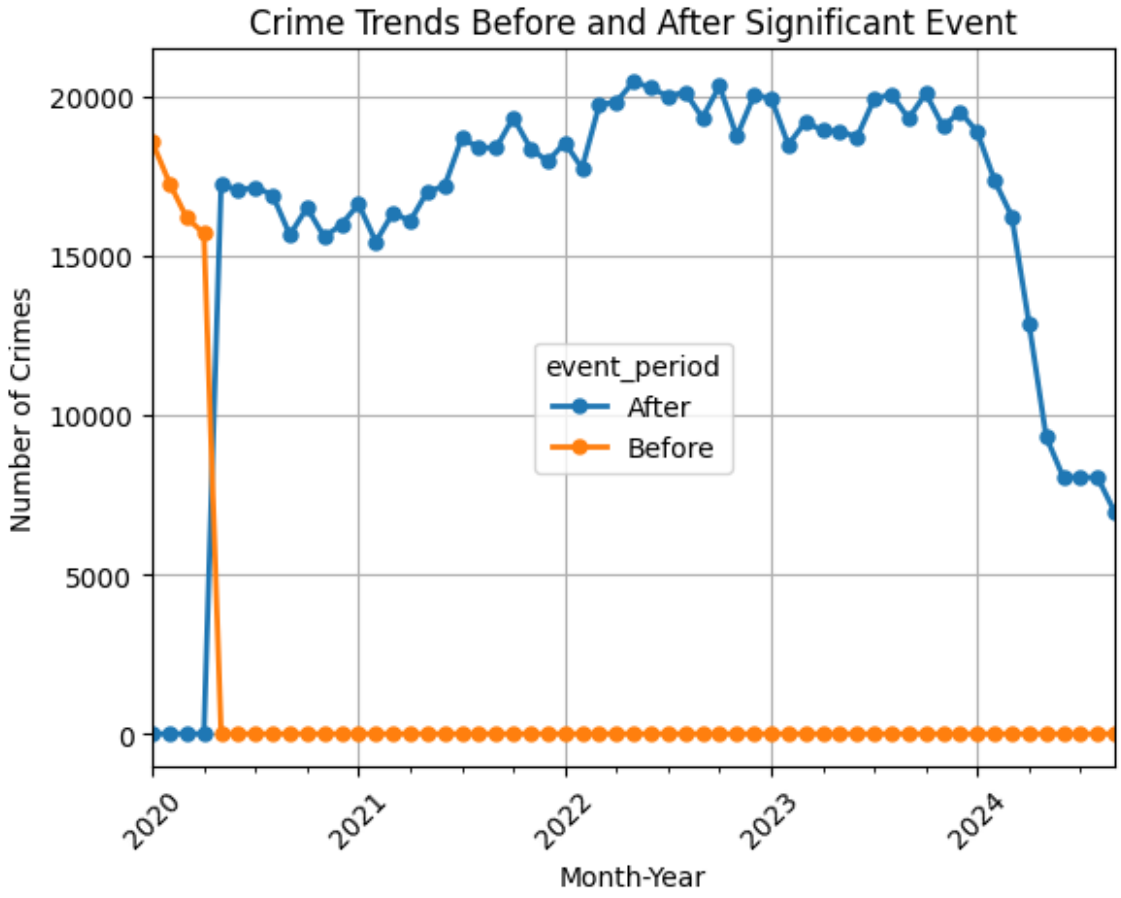
```
 16  Weapon Used Cd  326167 non-null  float64
 17  Weapon Desc     326167 non-null  object
 18  Status          982637 non-null  object
 19  Status Desc     982638 non-null  object
 20  Crm Cd 1        982627 non-null  float64
 21  Crm Cd 2        68875 non-null   float64
 22  Crm Cd 3        2311 non-null    float64
 23  Crm Cd 4        64 non-null      float64
 24  LOCATION        982638 non-null  object
 25  Cross Street    151849 non-null  object
 26  LAT             982638 non-null  float64
 27  LON             982638 non-null  float64
 28  year            982638 non-null  int32
 29  month           982638 non-null  object
dtypes: datetime64[ns](2), float64(8), int32(1), int64(7), object(12)
memory usage: 221.2+ MB
Looking at the dataset that has been provided,
Crime_Data_from_2020_to_Present.csv, it does not contain the required
column. Hence, a correlation cannot be found.

#Analyze the relationship between the day of the week and the
frequency of certain types of crimes.
crimeData['day_of_week'] = crimeData['DATE OCC'].dt.day_name()
crime_type_by_day = crimeData.pivot_table(index='day_of_week',
columns='Crm Cd Desc', aggfunc='size', fill_value=0)

crime_type_by_day = crime_type_by_day.reindex(['Monday', 'Tuesday',
'Wednesday', 'Thursday', 'Friday', 'Saturday', 'Sunday'])

plt.figure(figsize=(12, 8))
sns.heatmap(crime_type_by_day, cmap='Blues', linewidths=0.5)
plt.title('Heatmap of Crime Frequencies by Day of the Week and Crime
Type')
plt.xlabel('Crime Type')
plt.ylabel('Day of the Week')
plt.xticks(rotation=90)
plt.show()
```




```
#Investigate any impact of significant events or policy changes on
crime rates.
event_date = pd.to_datetime('2020-05-01')
```

```
crimeData['event_period'] = crimeData['DATE OCC'].apply(lambda x:
'Before' if x < event_date else 'After')
crimeData['month_year'] = crimeData['DATE OCC'].dt.to_period('M')
crime_trend = crimeData.groupby(['month_year',
'event_period']).size().unstack().fillna(0)

plt.figure(figsize=(10, 6))
crime_trend.plot(marker='o', linestyle='-', linewidth=2, markersize=5)
plt.title('Crime Trends Before and After Significant Event')
plt.xlabel('Month-Year')
plt.ylabel('Number of Crimes')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```

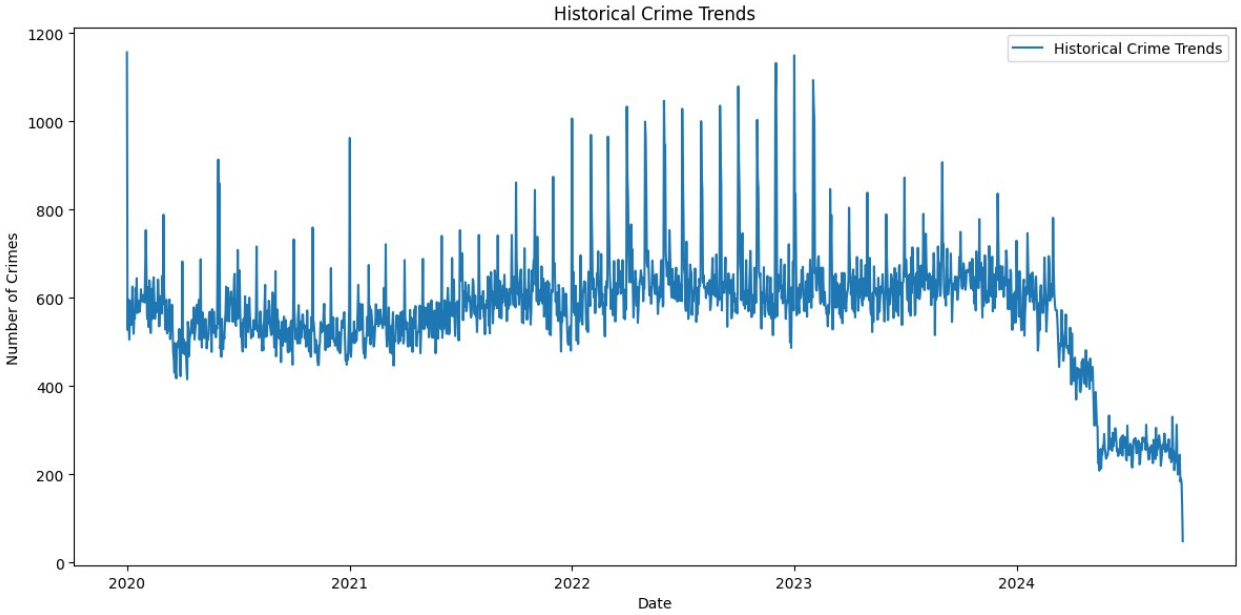
```
<Figure size 1000x600 with 0 Axes>
```

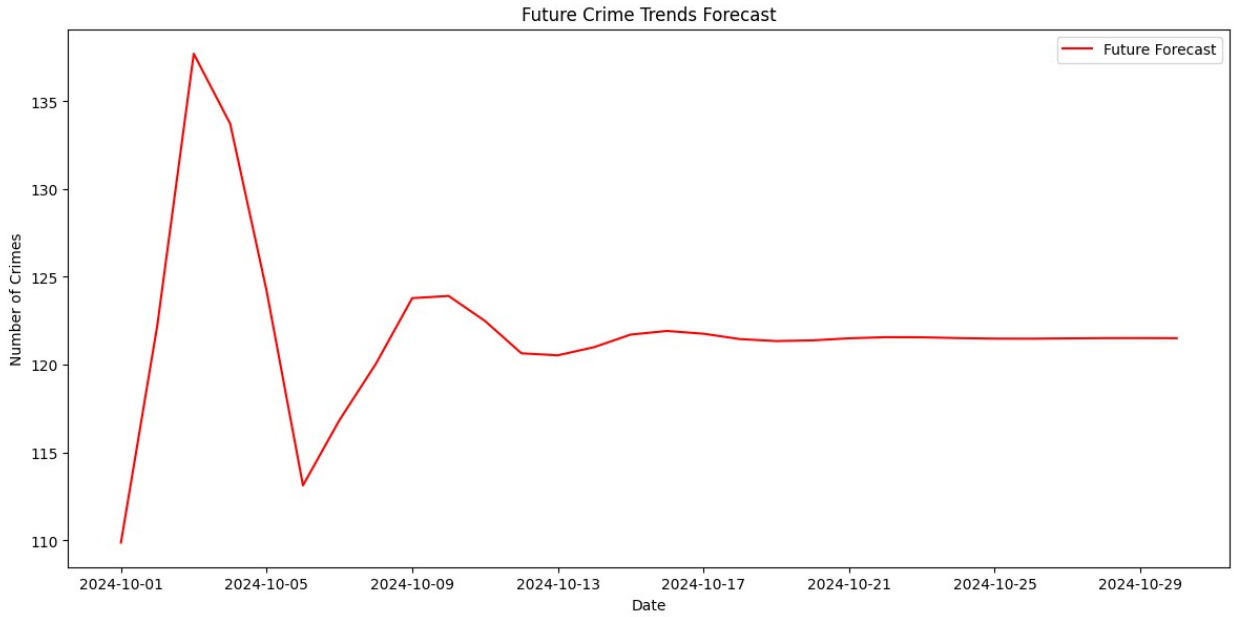


ADVANCED ANALYSIS :

```
#Use predictive modeling techniques (e.g., time series forecasting) to
predict future crime trends.
crimeData['DATE OCC'] = pd.to_datetime(crimeData['DATE OCC'])
```

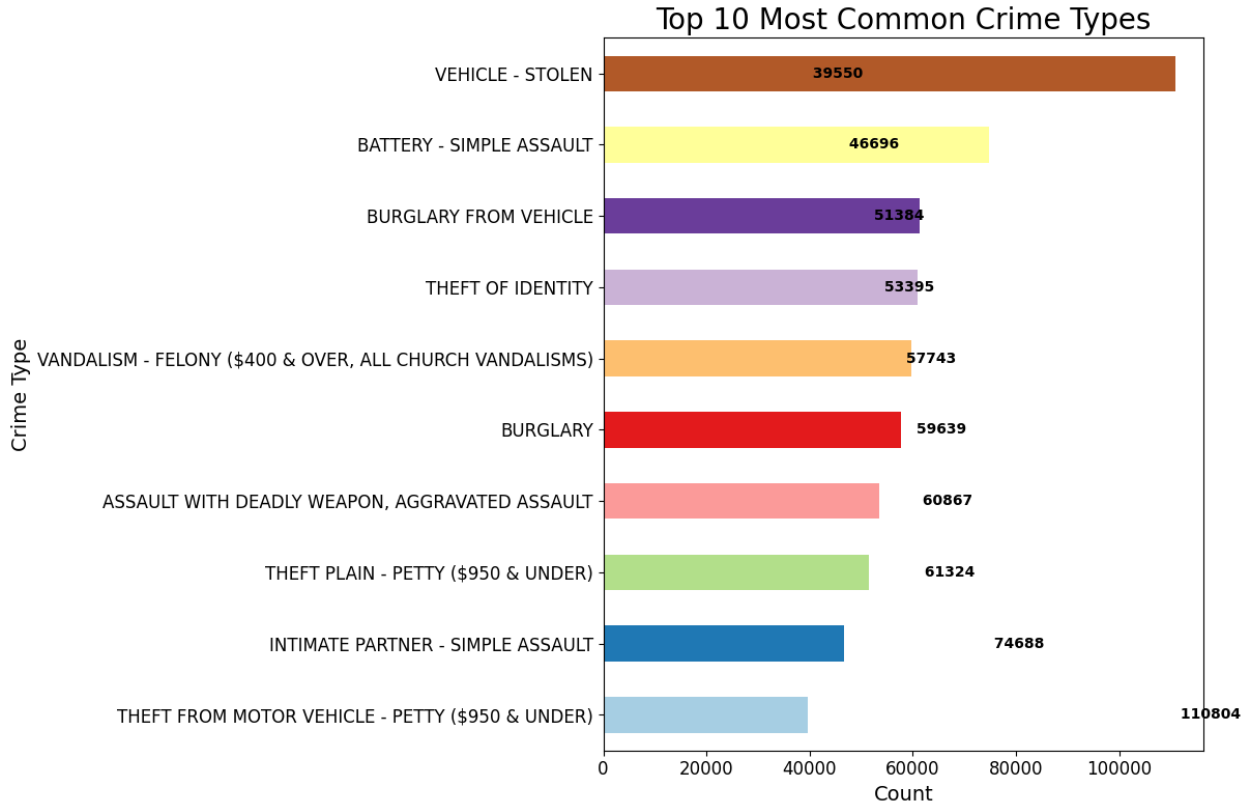
```
crime_series = crimeData.resample('D', on='DATE OCC').size()

model = ARIMA(crime_series, order=(5, 1, 0))
model_fit = model.fit()

future_forecast = model_fit.forecast(steps=30)

plt.figure(figsize=(12, 12))

plt.subplot(2, 1, 1)
plt.plot(crime_series, label='Historical Crime Trends')
plt.title('Historical Crime Trends')
plt.xlabel('Date')
plt.ylabel('Number of Crimes')
plt.legend()

plt.subplot(2, 1, 2)
plt.plot(pd.date_range(start=crime_series.index.max(), periods=31)
[1:], future_forecast, label='Future Forecast', color='red')
plt.title('Future Crime Trends Forecast')
plt.xlabel('Date')
plt.ylabel('Number of Crimes')
plt.legend()

plt.tight_layout()
plt.show()
```



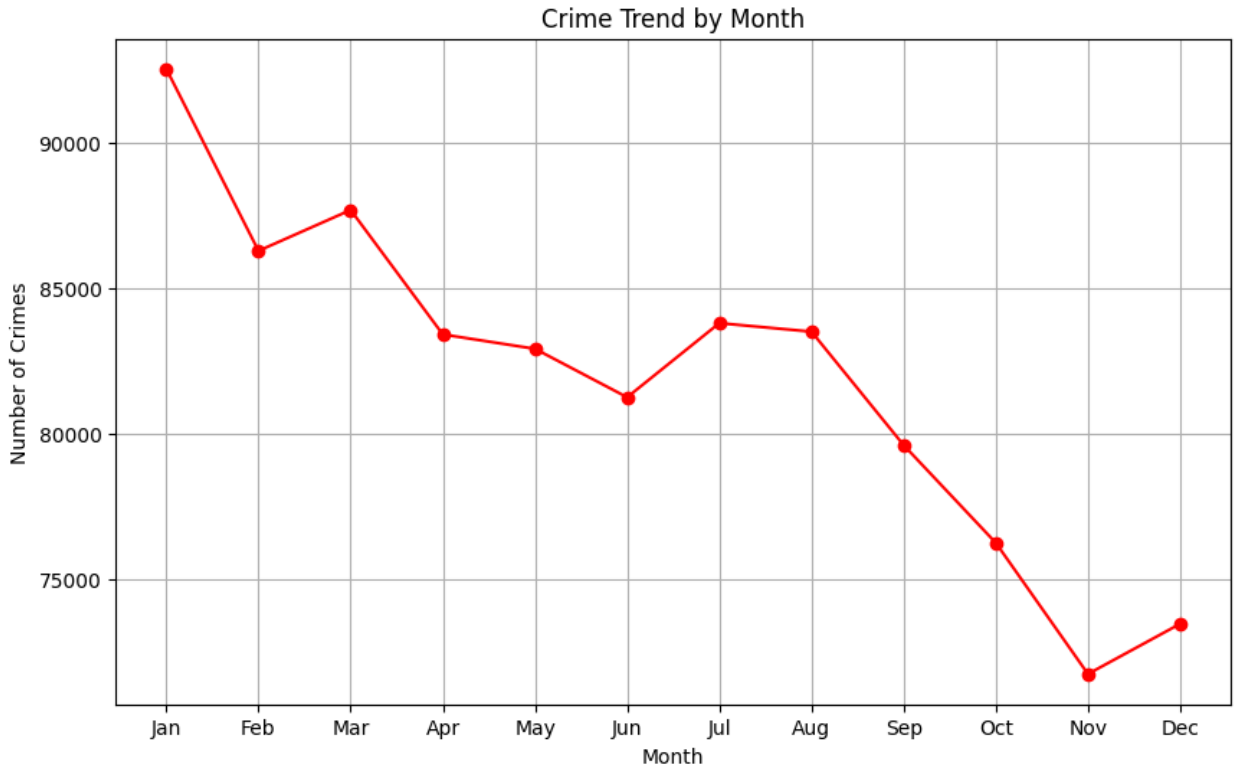



```
#Explore additional questions or hypotheses related to the dataset.

#Q1) What are the most common crime types reported?
crime_type_counts = crimeData['Crm Cd Desc'].value_counts().head(10)
plt.figure(figsize=(12, 8))
crime_type_counts.sort_values().plot(kind='barh',
color=plt.cm.Paired(np.linspace(0, 1, 10)))
plt.title('Top 10 Most Common Crime Types', fontsize=20)
plt.xlabel('Count', fontsize=14)
plt.ylabel('Crime Type', fontsize=14)
plt.tick_params(axis='both', which='major', labelsize=12)
for i, v in enumerate(crime_type_counts):
```

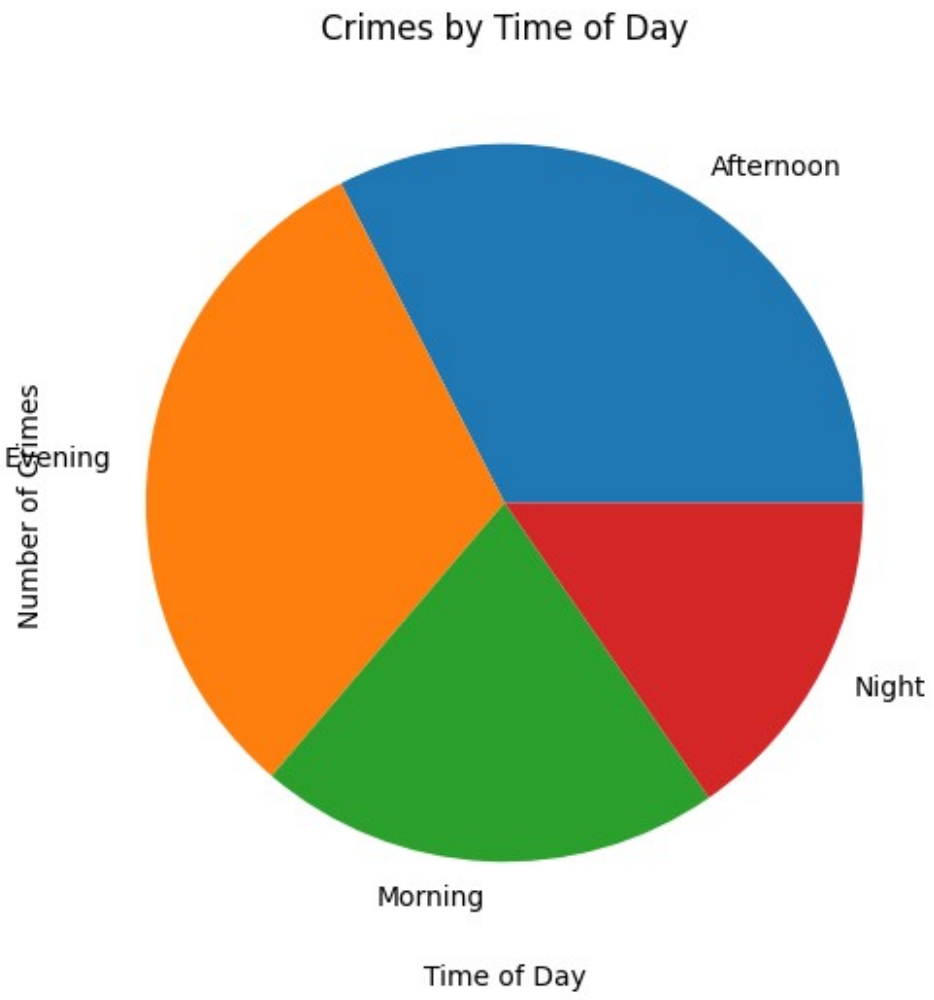
```
    plt.text(v, i, f' {v}', va='center', fontweight='bold')
plt.tight_layout()
plt.show()
```



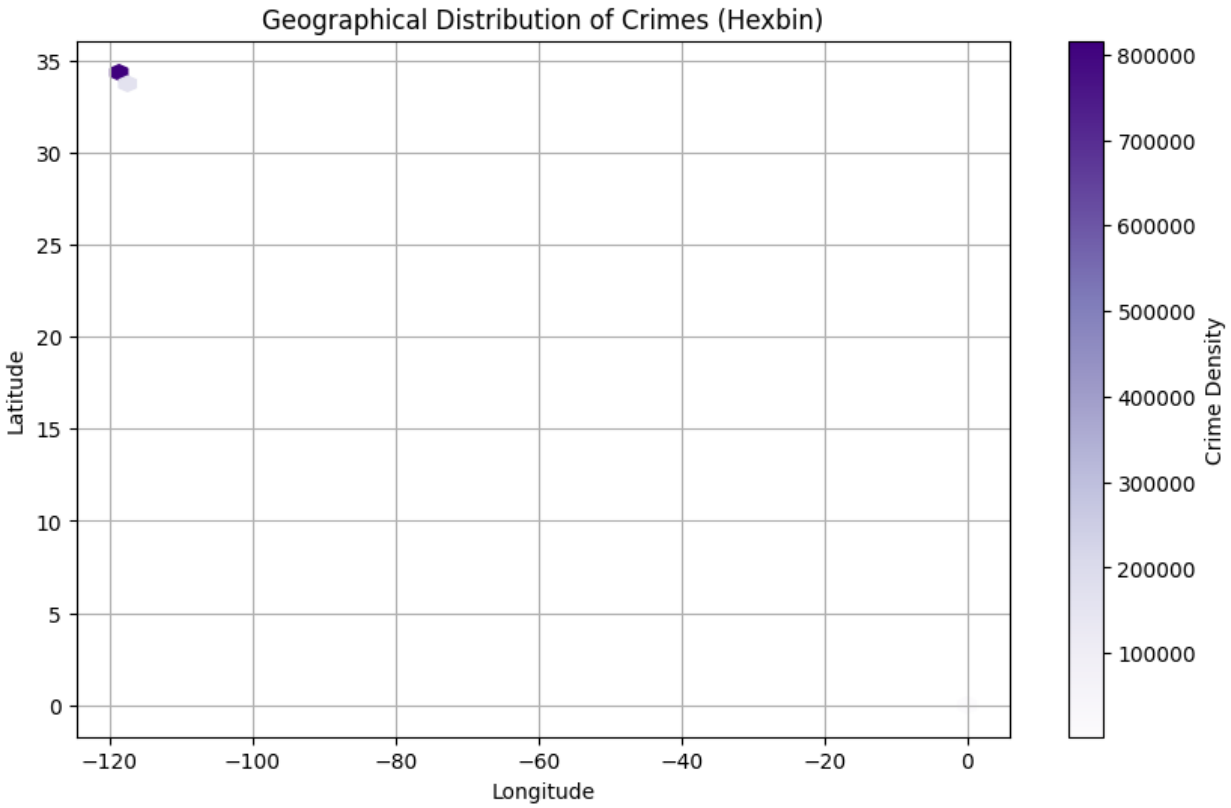

```
#Q2) Is there a seasonal trend in crime rates?
crimeData['DATE OCC'] = pd.to_datetime(crimeData['DATE OCC'],
errors='coerce')

crimeData['month'] = crimeData['DATE OCC'].dt.month

crime_by_month = crimeData.groupby('month').size()

crime_by_month.plot(kind='line', marker='o', figsize=(10, 6),
color='red')
plt.title('Crime Trend by Month')
plt.xlabel('Month')
plt.ylabel('Number of Crimes')
plt.xticks(range(1, 13), ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun',
'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec'])
plt.grid(True)
plt.show()
```




```
#Q3) Are there certain times of day when crime is more prevalent?
crimeData['Time of Day'] = pd.cut(crimeData['TIME OCC'],
                                  bins=[0, 600, 1200, 1800, 2400],
                                  labels=['Night', 'Morning',
'Afternoon', 'Evening'],
                                  right=False)

time_of_day_counts = crimeData['Time of Day'].value_counts()

time_of_day_counts.plot(kind='pie', color='lightgreen', figsize=(10,
6))
plt.title('Crimes by Time of Day')
plt.xlabel('Time of Day')
plt.ylabel('Number of Crimes')
plt.xticks(rotation=0)
plt.show()
```

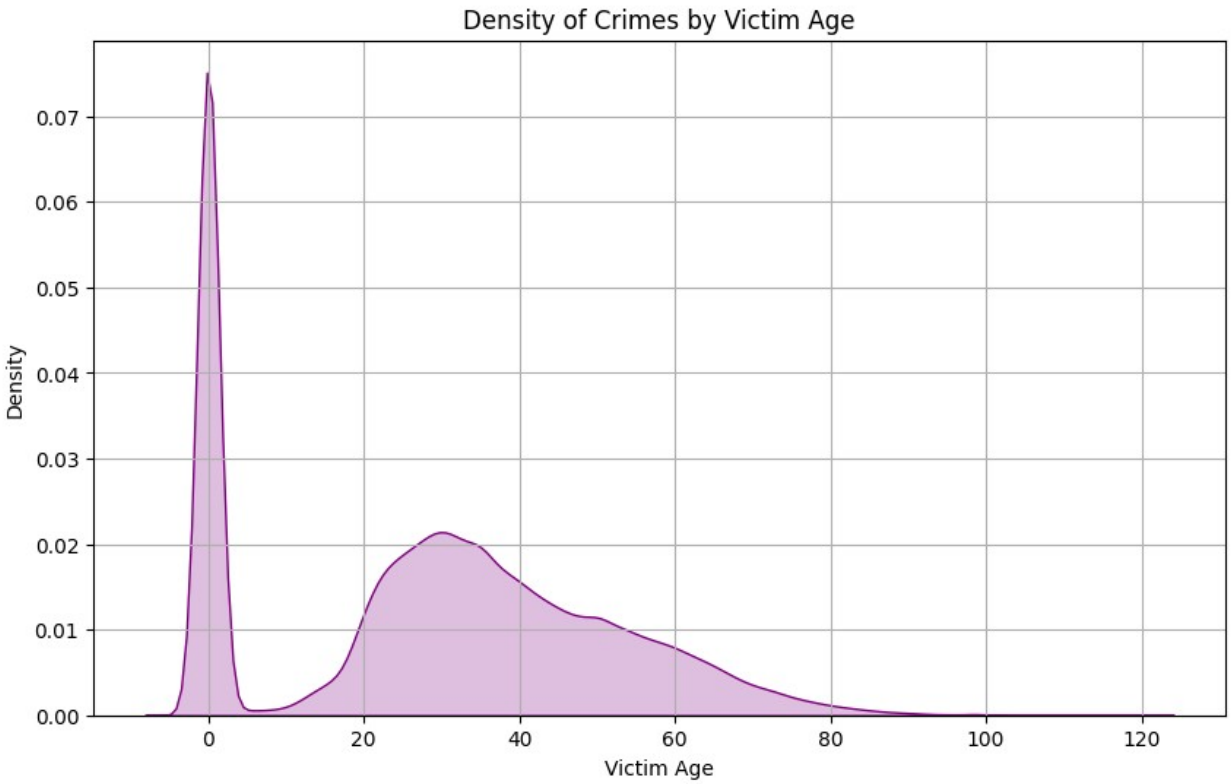


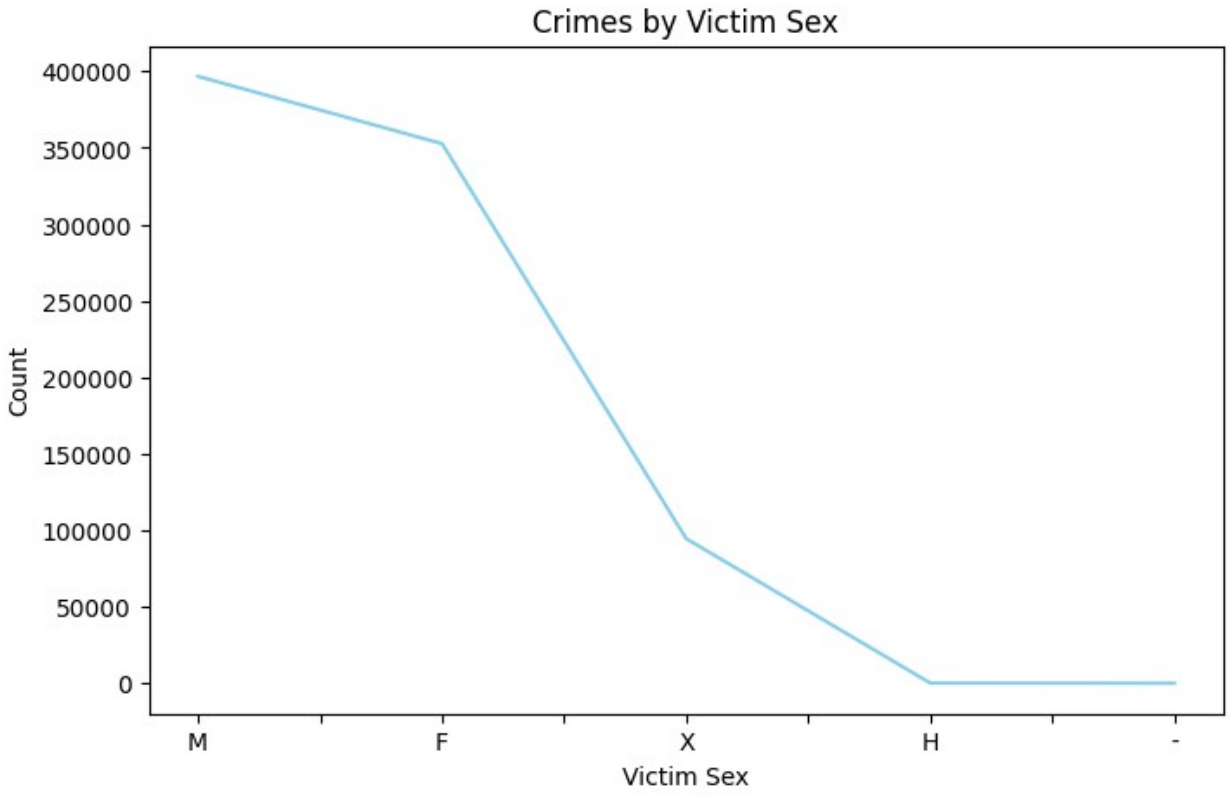

```
#Q4) Is there a correlation between crime occurrence and location
(latitude and longitude)?
plt.figure(figsize=(10, 6))
plt.hexbin(crimeData['LON'], crimeData['LAT'], gridsize=50,
cmap='Purples', mincnt=1)
plt.colorbar(label='Crime Density')
plt.title('Geographical Distribution of Crimes (Hexbin)')
plt.xlabel('Longitude')
plt.ylabel('Latitude')
plt.grid(True)
plt.show()
```

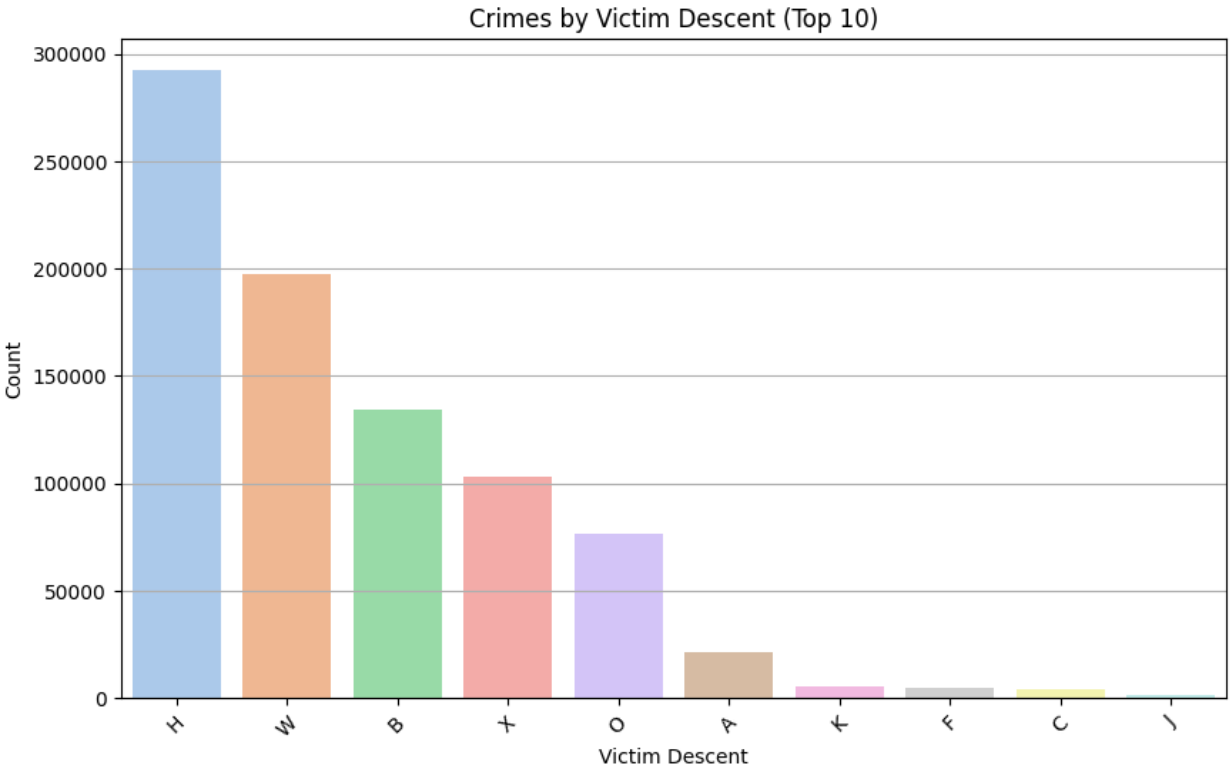



```
#Q5) Do certain victim characteristics (age, gender, descent) affect
crime occurrence?
plt.figure(figsize=(10, 6))
sns.kdeplot(crimeData['Vict Age'], color='purple', fill=True)
plt.title('Density of Crimes by Victim Age')
plt.xlabel('Victim Age')
plt.ylabel('Density')
plt.grid(True)
plt.show()

victim_sex_counts = crimeData['Vict Sex'].value_counts()

victim_sex_counts.plot(kind='line', color='skyblue', figsize=(8, 5))
plt.title('Crimes by Victim Sex')
plt.xlabel('Victim Sex')
plt.ylabel('Count')
plt.xticks(rotation=0)
plt.show()

top_victim_descent_counts = crimeData['Vict
Descent'].value_counts().head(10).reset_index()
top_victim_descent_counts.columns = ['Victim Descent', 'Count']

plt.figure(figsize=(10, 6))
sns.barplot(x='Victim Descent', y='Count',
```

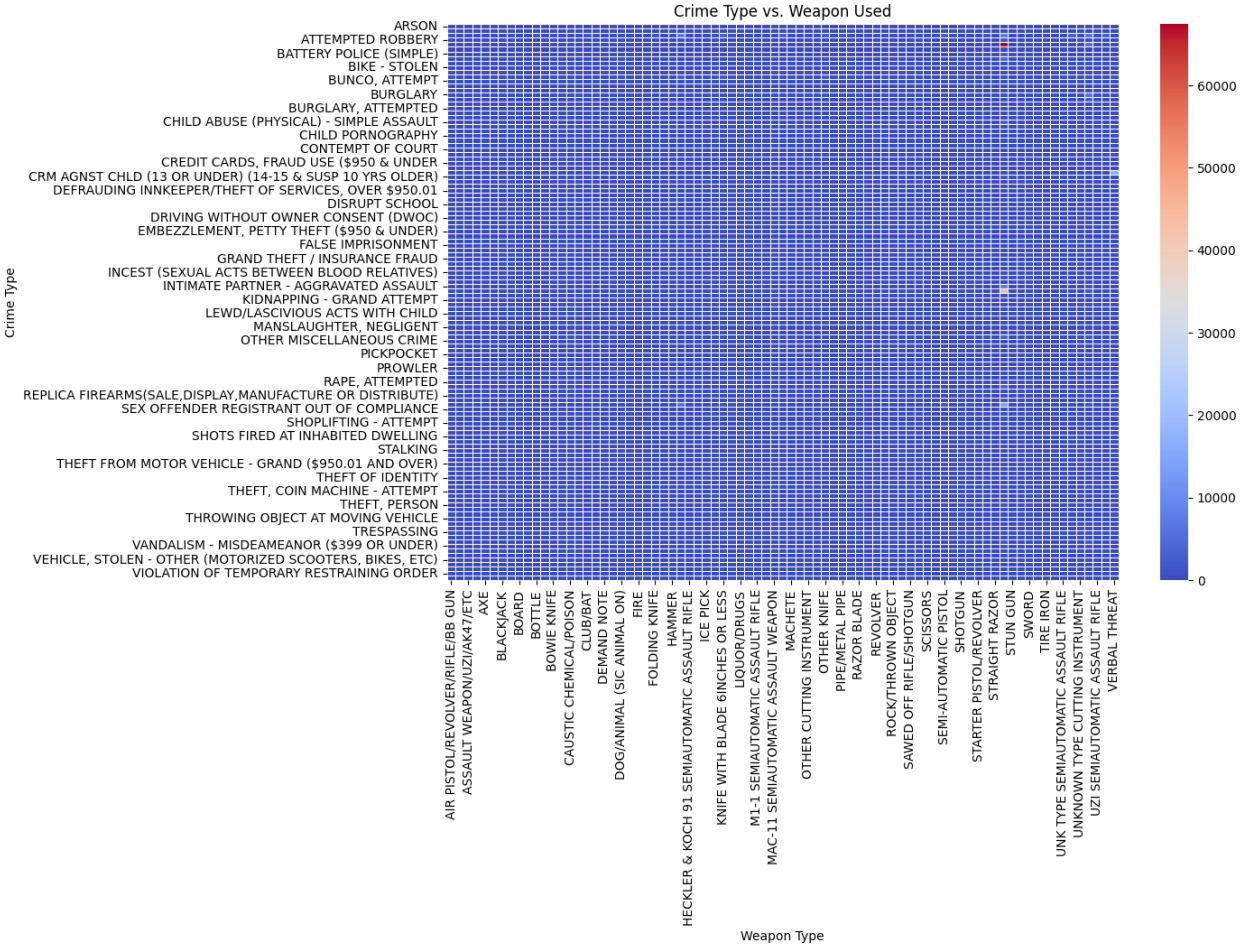
```
data=top_victim_descent_counts, hue='Victim Descent', dodge=False,
palette='pastel', legend=False)
plt.title('Crimes by Victim Descent (Top 10)')
plt.xlabel('Victim Descent')
plt.ylabel('Count')
plt.xticks(rotation=45)
plt.grid(axis='y')
plt.show()
```




Crimes by Victim Sex
400000
350000
300000
250000
200000
150000
100000
50000
0
Count
M
F
X
H
-
Victim Sex


Crimes by Victim Descent (Top 10)
300000
250000
200000
150000
100000
50000
0
Count
H
W
B
X
O
A
K
F
C
J
Victim Descent

```
#Q6) What is the relationship between crime type and the type of weapon used?
crime_weapon = crimeData.groupby(['Crm Cd Desc', 'Weapon Desc']).size().unstack().fillna(0)

plt.figure(figsize=(12, 8))
sns.heatmap(crime_weapon, cmap='coolwarm', linewidths=0.5)
plt.title('Crime Type vs. Weapon Used')
plt.xlabel('Weapon Type')
plt.ylabel('Crime Type')
plt.show()
```




```
#Q7) What are the most dangerous areas based on the frequency of crimes?
area_crime_counts = crimeData['AREA NAME'].value_counts()

plt.figure(figsize=(10, 6))
area_crime_counts.head(10).plot(kind='barh', color='salmon')
plt.title('Top 10 Most Dangerous Areas Based on Crime Frequency')
plt.xlabel('Number of Crimes')
```

```
plt.ylabel('Area Name')
plt.grid(axis='x')
plt.show()
```