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# Core Libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

# Interactive Visuals
import folium
from folium.plugins import HeatMap

# System & Plot Settings
import warnings
warnings.filterwarnings('ignore')
%matplotlib inline


# Step 3: Load the Data
df = pd.read_csv('US_Accidents_March23.csv', nrows=100000)
print("Shape of dataset:", df.shape)
df.head()
df.info()
df.describe()
df.isna().sum().sort_values(ascending=False).head(20)
df.dropna(subset=["Start_Lat", "Start_Lng"], inplace=True)

# Convert time
df['Start_Time'] = pd.to_datetime(df['Start_Time'])
df['Year'] = df['Start_Time'].dt.year
df['Month'] = df['Start_Time'].dt.month
df['Day'] = df['Start_Time'].dt.day
df['Hour'] = df['Start_Time'].dt.hour
df['DayOfWeek'] = df['Start_Time'].dt.dayofweek


# Step 6: Accidents by Time of Day
plt.figure(figsize=(10,5))
sns.countplot(x='Hour', data=df, palette='coolwarm')
plt.title('Accidents by Hour of Day')
plt.xlabel('Hour')
plt.ylabel('Accident Count')
plt.show()
# Step 7: Accidents by Weather Condition
plt.figure(figsize=(12,6))
sns.countplot(y='Weather_Condition', data=df,
order=df['Weather_Condition'].value_counts()[:10].index,
palette='viridis')
plt.title('Top 10 Weather Conditions in Accidents')
plt.show()
plt.figure(figsize=(14,6))
df['State'].value_counts()[:15].plot(kind='barh', color='teal')
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plt.title('Top 15 States with Highest Number of Accidents')
plt.xlabel('Number of Accidents')
plt.gca().invert_yaxis()
plt.show()
plt.figure(figsize=(8,5))
sns.countplot(x='Severity', data=df, palette='Set2')
plt.title('Accident Severity Distribution')
plt.xlabel('Severity (1: Low – 4: High)')
plt.ylabel('Count')
plt.show()

sample_df = df[['Start_Lat', 'Start_Lng']].sample(n=10000)

map_us = folium.Map(location=[39.8283, -98.5795], zoom_start=4)  # USA
center
HeatMap(data=sample_df.values.tolist(), radius=10).add_to(map_us)
map_us
dow = ['Mon', 'Tue', 'Wed', 'Thu', 'Fri', 'Sat', 'Sun']
df['DayOfWeek'] = df['Start_Time'].dt.dayofweek
df['DayOfWeekName'] = df['DayOfWeek'].apply(lambda x: dow[x])

plt.figure(figsize=(8,4))
sns.countplot(x='DayOfWeekName', data=df, order=dow, palette='Accent')
plt.title('Accidents by Day of the Week')
plt.show()


Shape of dataset: (100000, 46)
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100000 entries, 0 to 99999
Data columns (total 46 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   ID                     100000 non-null  object
 1   Source                 100000 non-null  object
 2   Severity               100000 non-null  int64
 3   Start_Time             100000 non-null  object
 4   End_Time               100000 non-null  object
 5   Start_Lat              100000 non-null  float64
 6   Start_Lng              100000 non-null  float64
 7   End_Lat                0 non-null       float64
 8   End_Lng                0 non-null       float64
 9   Distance(mi)           100000 non-null  float64
 10  Description            100000 non-null  object
 11  Street                 100000 non-null  object
 12  City                   99999 non-null   object
 13  County                 100000 non-null  object
 14  State                  100000 non-null  object
 15  Zipcode                99993 non-null   object
 16  Country                100000 non-null  object
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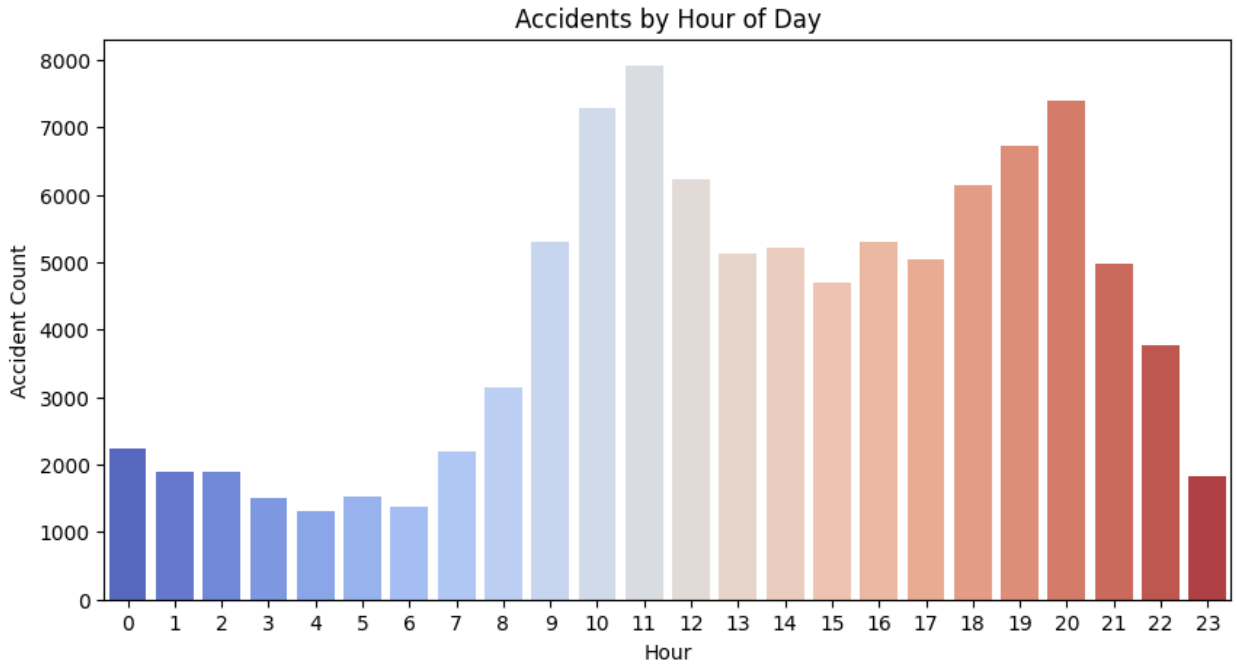
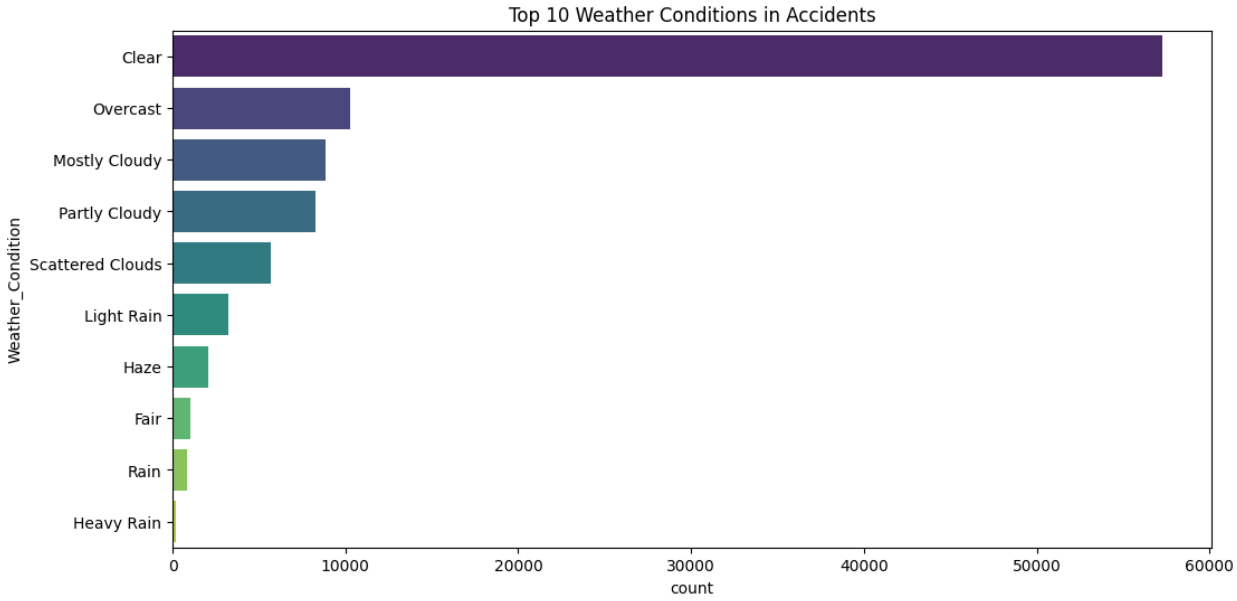
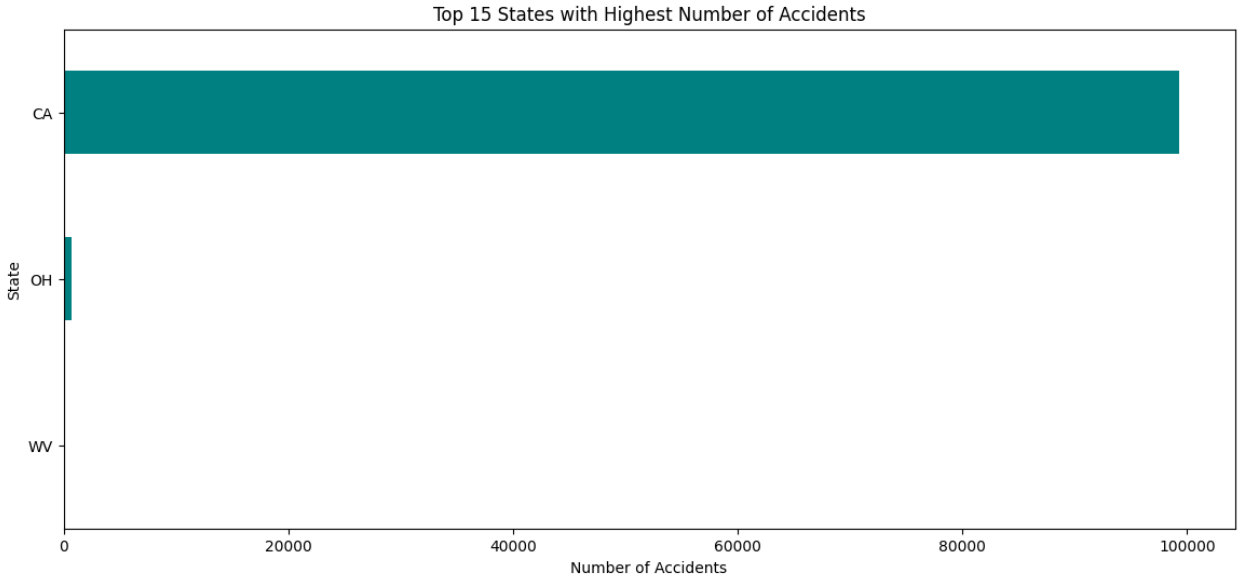
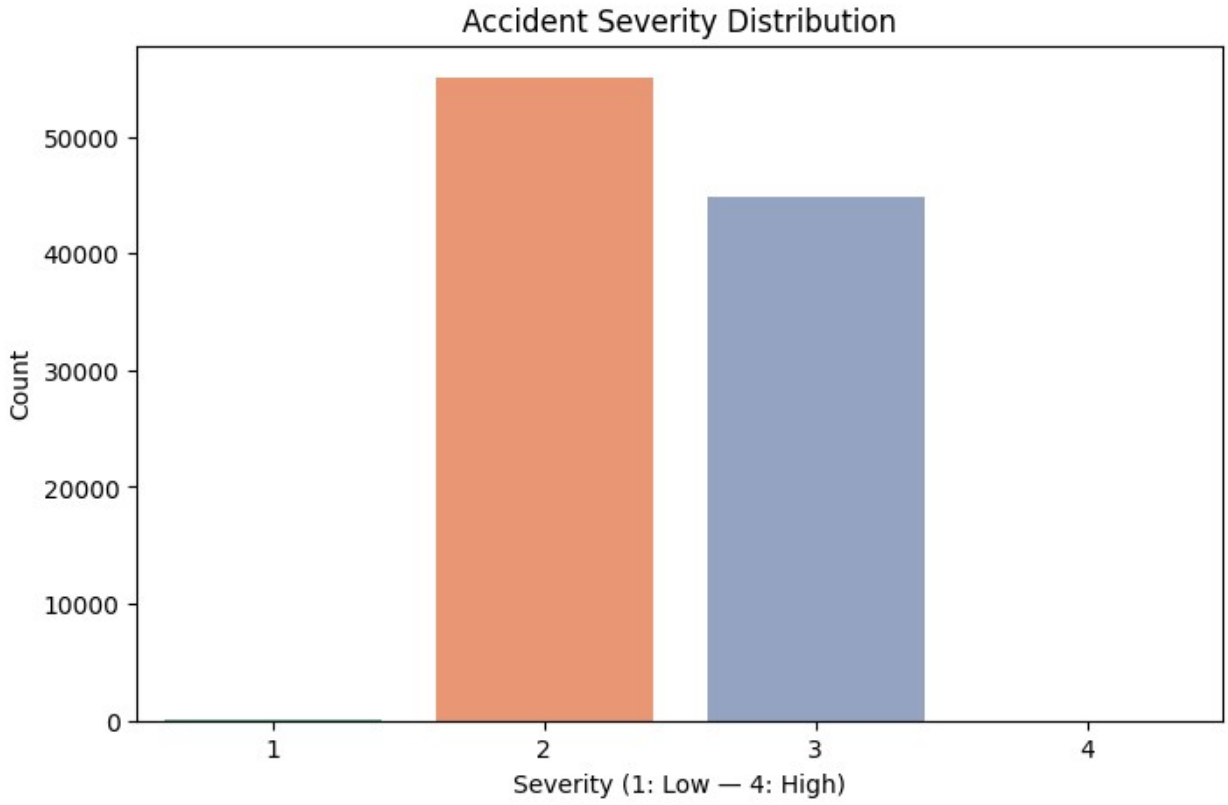
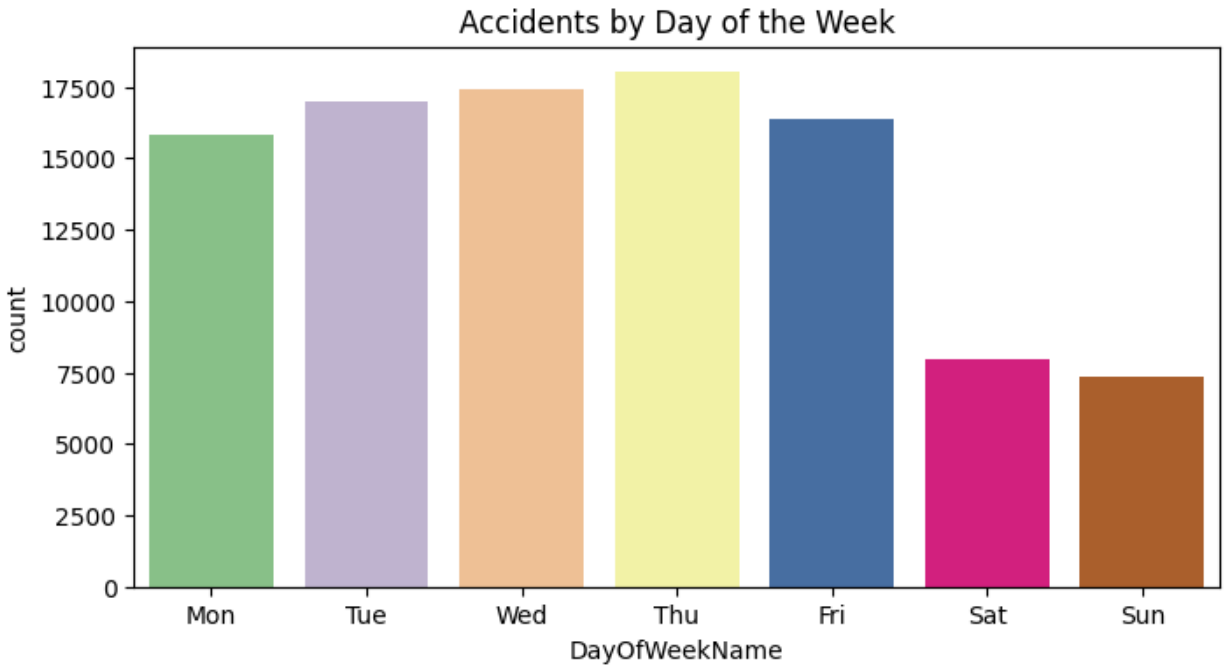
 17  Timezone                99993 non-null   object
 18  Airport_Code            99993 non-null   object
 19  Weather_Timestamp       98946 non-null   object
 20  Temperature(F)          98409 non-null   float64
 21  Wind_Chill(F)           4322 non-null    float64
 22  Humidity(%)             98144 non-null   float64
 23  Pressure(in)            98708 non-null   float64
 24  Visibility(mi)          98154 non-null   float64
 25  Wind_Direction          98936 non-null   object
 26  Wind_Speed(mph)         76180 non-null   float64
 27  Precipitation(in)       7368 non-null    float64
 28  Weather_Condition       98396 non-null   object
 29  Amenity                 100000 non-null  bool
 30  Bump                    100000 non-null  bool
 31  Crossing                100000 non-null  bool
 32  Give_Way                100000 non-null  bool
 33  Junction                100000 non-null  bool
 34  No_Exit                 100000 non-null  bool
 35  Railway                 100000 non-null  bool
 36  Roundabout              100000 non-null  bool
 37  Station                 100000 non-null  bool
 38  Stop                    100000 non-null  bool
 39  Traffic_Calming         100000 non-null  bool
 40  Traffic_Signal          100000 non-null  bool
 41  Turning_Loop            100000 non-null  bool
 42  Sunrise_Sunset          99999 non-null   object
 43  Civil_Twilight          99999 non-null   object
 44  Nautical_Twilight       99999 non-null   object
 45  Astronomical_Twilight   99999 non-null   object
dtypes: bool(13), float64(12), int64(1), object(20)
memory usage: 26.4+ MB
```


Accidents by Hour of Day
Accident Count
Hour
0
1000
2000
3000
4000
5000
6000
7000
8000
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23


Top 10 Weather Conditions in Accidents
Weather_Condition
Clear
Overcast
Mostly Cloudy
Partly Cloudy
Scattered Clouds
Light Rain
Haze
Fair
Rain
Heavy Rain
0
10000
20000
30000
40000
50000
60000
count


Top 15 States with Highest Number of Accidents
CA
OH
WV
State
0
20000
40000
60000
80000
100000
Number of Accidents


Accident Severity Distribution
50000
40000
30000
20000
10000
0
Count
1
2
3
4
Severity (1: Low — 4: High)


Accidents by Day of the Week
17500
15000
12500
10000
7500
5000
2500
0
count
Mon
Tue
Wed
Thu
Fri
Sat
Sun
DayOfWeekName