```
import pandas as pd

# Load the dataset
df = pd.read_csv('US_Accidents_March23.csv')  # Assuming you've
downloaded the dataset

# Preview the data
df.head()

    ID   Source  Severity           Start_Time             End_Time  \
0  A-1  Source2         3  2016-02-08 05:46:00  2016-02-08 11:00:00
1  A-2  Source2         2  2016-02-08 06:07:59  2016-02-08 06:37:59
2  A-3  Source2         2  2016-02-08 06:49:27  2016-02-08 07:19:27
3  A-4  Source2         3  2016-02-08 07:23:34  2016-02-08 07:53:34
4  A-5  Source2         2  2016-02-08 07:39:07  2016-02-08 08:09:07

   Start_Lat  Start_Lng  End_Lat  End_Lng  Distance(mi)  ...
Roundabout  \
0  39.865147 -84.058723      NaN      NaN          0.01  ...
False
1  39.928059 -82.831184      NaN      NaN          0.01  ...
False
2  39.063148 -84.032608      NaN      NaN          0.01  ...
False
3  39.747753 -84.205582      NaN      NaN          0.01  ...
False
4  39.627781 -84.188354      NaN      NaN          0.01  ...
False

  Station   Stop Traffic_Calming Traffic_Signal Turning_Loop
Sunrise_Sunset  \
0   False  False           False          False        False
Night
1   False  False           False          False        False
Night
2   False  False           False           True        False
Night
3   False  False           False          False        False
Night
4   False  False           False           True        False
Day

  Civil_Twilight Nautical_Twilight Astronomical_Twilight
0          Night             Night                 Night
1          Night             Night                   Day
2          Night               Day                   Day
3            Day               Day                   Day
4            Day               Day                   Day

[5 rows x 46 columns]
```

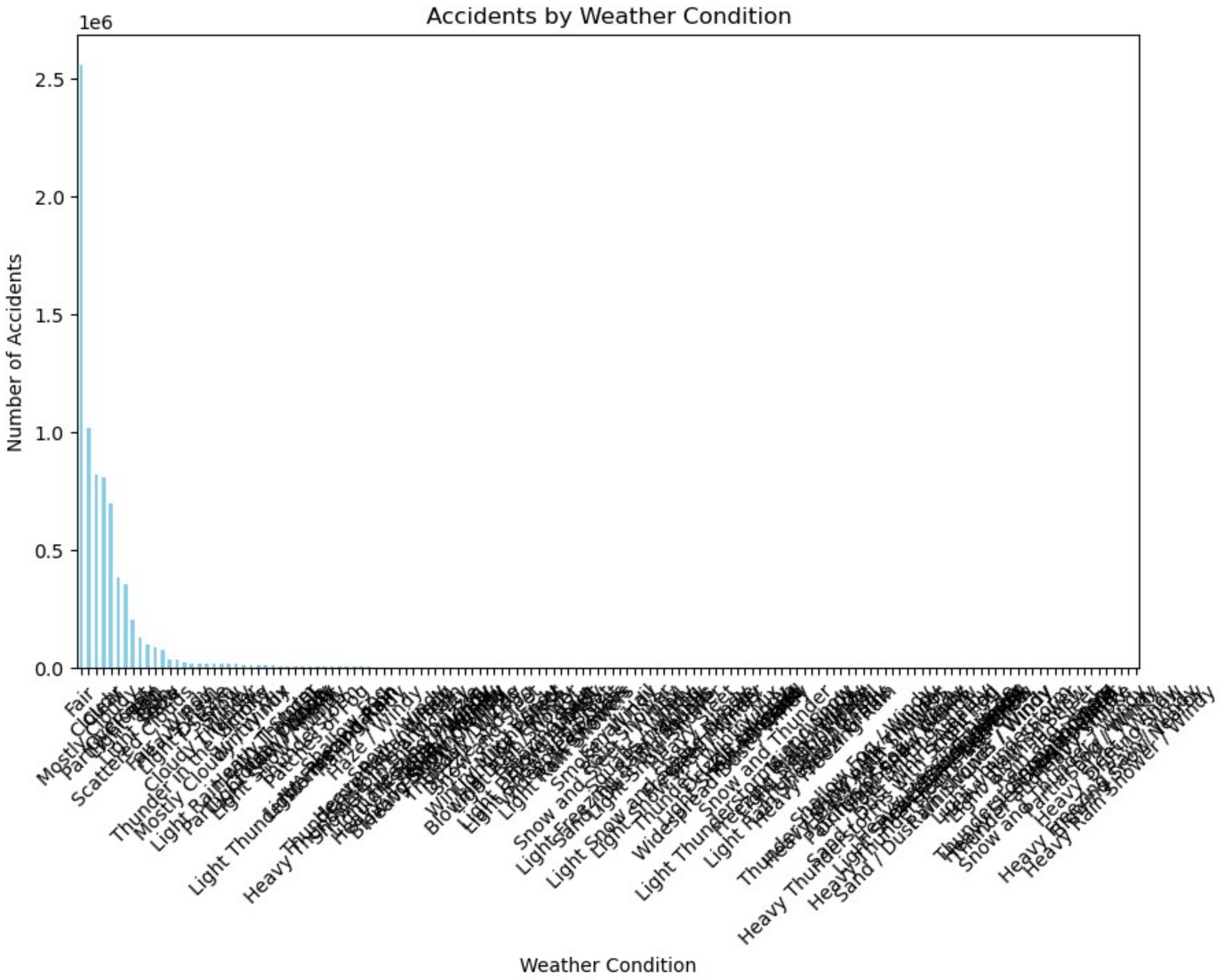
```
# Check the column names of the dataset
df.columns
```

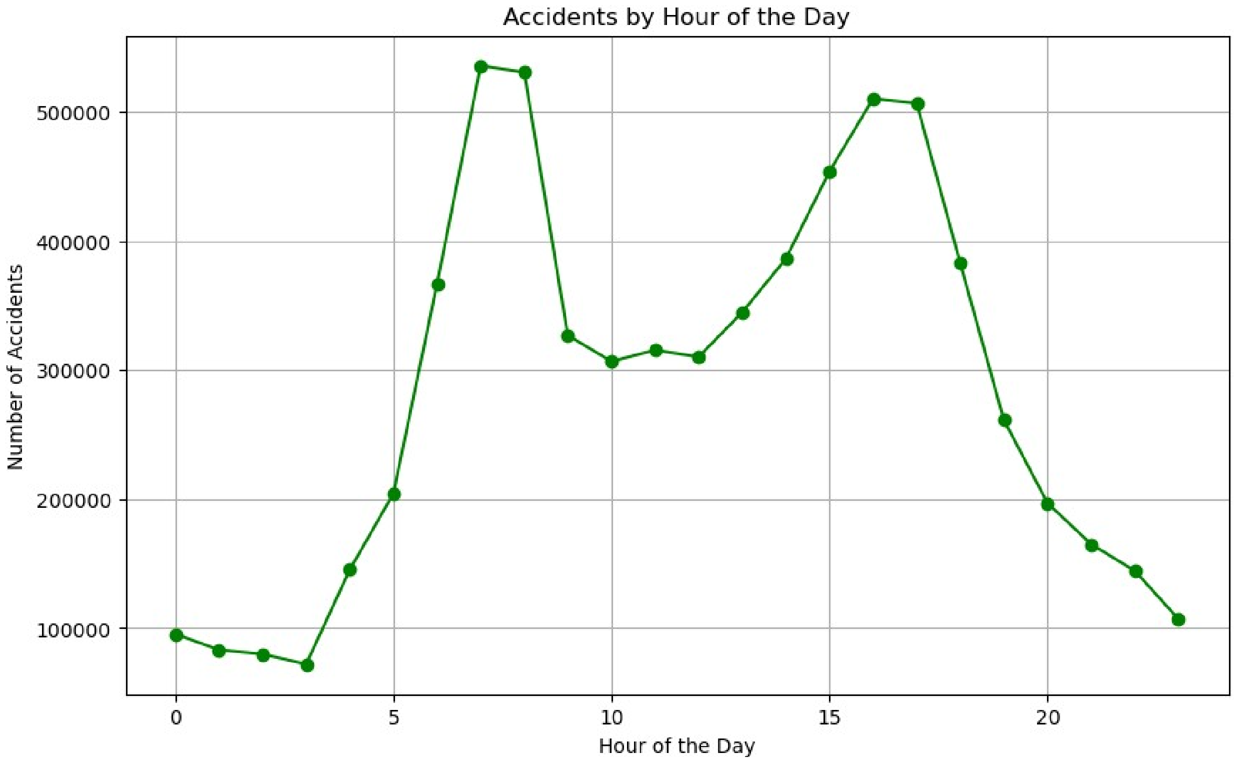
```
Index(['ID', 'Source', 'Severity', 'Start_Time', 'End_Time',
'Start_Lat',
       'Start_Lng', 'End_Lat', 'End_Lng', 'Distance(mi)',
'Description',
       'Street', 'City', 'County', 'State', 'Zipcode', 'Country',
'Timezone',
       'Airport_Code', 'Weather_Timestamp', 'Temperature(F)',
'Wind_Chill(F)',
       'Humidity(%)', 'Pressure(in)', 'Visibility(mi)',
'Wind_Direction',
       'Wind_Speed(mph)', 'Precipitation(in)', 'Weather_Condition',
'Amenity',
       'Bump', 'Crossing', 'Give_Way', 'Junction', 'No_Exit',
'Railway',
       'Roundabout', 'Station', 'Stop', 'Traffic_Calming',
'Traffic_Signal',
       'Turning_Loop', 'Sunrise_Sunset', 'Civil_Twilight',
'Nautical_Twilight',
       'Astronomical_Twilight', 'Hour', 'DayOfWeek', 'Month'],
      dtype='object')
```

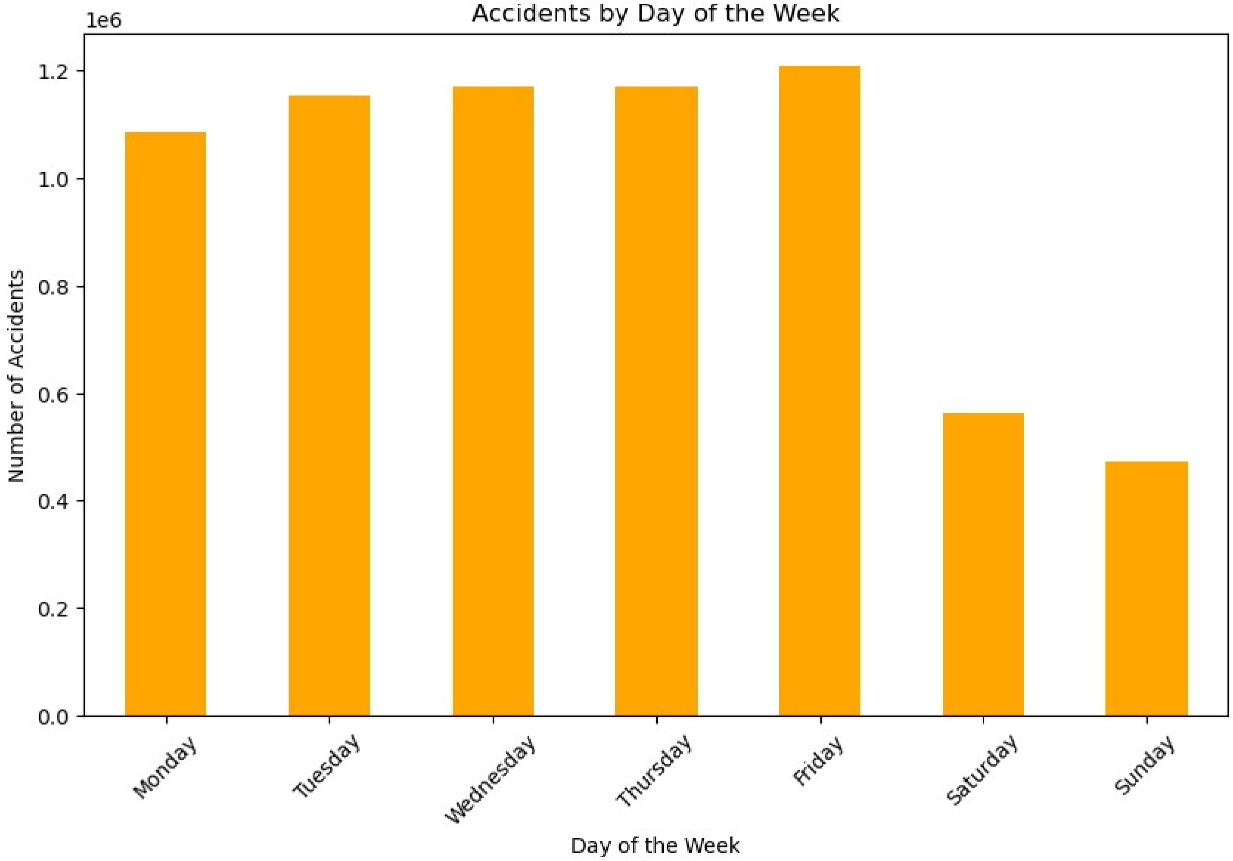
```
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import folium
from folium.plugins import HeatMap



# Convert 'Start_Time' to datetime
df['Start_Time'] = pd.to_datetime(df['Start_Time'])

# Feature Engineering: Extract hour, day, and month from 'Start_Time'
df['Hour'] = df['Start_Time'].dt.hour
df['DayOfWeek'] = df['Start_Time'].dt.dayofweek  # 0 = Monday, 6 =
Sunday
df['Month'] = df['Start_Time'].dt.month

# Handle missing values (drop rows with missing critical columns)
df.dropna(subset=['Start_Lat', 'Start_Lng', 'Weather_Condition'],
inplace=True)

# 1. Weather Condition Analysis

# Count accidents by weather condition
weather_counts = df['Weather_Condition'].value_counts()
```

```
# Plot weather conditions contributing to accidents
plt.figure(figsize=(10,6))
weather_counts.plot(kind='bar', color='skyblue')
plt.title('Accidents by Weather Condition')
plt.xlabel('Weather Condition')
plt.ylabel('Number of Accidents')
plt.xticks(rotation=45)
plt.show()

# 2. Time of Day Analysis (Accidents by Hour of the Day)
hourly_accidents = df['Hour'].value_counts().sort_index()

plt.figure(figsize=(10,6))
hourly_accidents.plot(kind='line', marker='o', color='green')
plt.title('Accidents by Hour of the Day')
plt.xlabel('Hour of the Day')
plt.ylabel('Number of Accidents')
plt.grid(True)
plt.show()

# 3. Day of Week Analysis
weekday_accidents = df['DayOfWeek'].value_counts().sort_index()

# Map days of the week to names
days_of_week = ['Monday', 'Tuesday', 'Wednesday', 'Thursday',
'Friday', 'Saturday', 'Sunday']
weekday_accidents.index = days_of_week

plt.figure(figsize=(10,6))
weekday_accidents.plot(kind='bar', color='orange')
plt.title('Accidents by Day of the Week')
plt.xlabel('Day of the Week')
plt.ylabel('Number of Accidents')
plt.xticks(rotation=45)
plt.show()

# 4. Accident Hotspot Visualization on Map (using Lat/Lng)
# Creating a Folium map centered around the average accident
coordinates
m = folium.Map(location=[df['Start_Lat'].mean(),
df['Start_Lng'].mean()], zoom_start=6)

# Add HeatMap to visualize accident hotspots
heat_data = [[row['Start_Lat'], row['Start_Lng']] for index, row in
df.iterrows()]
HeatMap(heat_data).add_to(m)

# Save the map to an HTML file for visualization
m.save('accident_hotspots_map.html')
```

```
# 5. Severity by Weather Condition
severity_weather = df.groupby('Weather_Condition')
['Severity'].value_counts().unstack().fillna(0)

# Plot the severity distribution by weather condition
severity_weather.plot(kind='bar', stacked=True, figsize=(12, 8),
color=['red', 'yellow', 'green', 'blue'])
plt.title('Accident Severity by Weather Condition')
plt.xlabel('Weather Condition')
plt.ylabel('Number of Accidents')
plt.xticks(rotation=45)
plt.show()

# 6. Correlation Heatmap (Accident Severity and Contributing Factors)
df['Weather_Condition'] =
df['Weather_Condition'].astype('category').cat.codes  # Convert
categorical to numerical
df['Hour'] = df['Hour'].astype('category').cat.codes  # Convert hour
to numerical
df['DayOfWeek'] = df['DayOfWeek'].astype('category').cat.codes  #
Convert day of week to numerical

# Create a correlation matrix
corr_matrix = df[['Severity', 'Weather_Condition', 'Hour',
'DayOfWeek', 'Temperature(F)', 'Wind_Speed(mph)',
'Precipitation(in)']].corr()

# Plot the correlation heatmap
plt.figure(figsize=(10,6))
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', fmt='.2f',
vmin=-1, vmax=1)
plt.title('Correlation Heatmap of Accident Severity and Contributing
Factors')
plt.show()
```


Accidents by Weather Condition
1e6
2.5
2.0
1.5
1.0
0.5
0.0
Number of Accidents
Fair
Cloudy
Mostly Cloudy
Partly Cloudy
Scattered Clouds
Light Drizzle
Cloudy / Windy
Thunder in the Vicinity
Mostly Cloudy / Windy
Light Rain with Thunder
Patches of Fog
Light Thunderstorms and Rain
Haze / Windy
Heavy Thunderstorms and Rain
Blowing
Smoke
Snow and Sleet
Light Freezing
Sand
Light Snow and Sleet
Widespread Dust
Light Thunderstorms and Snow
Snow and Thunder
Light Rain
Heavy Freezing Rain
Thunder
Shallow Fog / Windy
Heavy Thunderstorms with Small Hail
Sand / Dust Whirlwinds
Snow and Thunder
Heavy
Heavy Rain Shower / Windy
Weather Condition


Accidents by Hour of the Day
Number of Accidents
500000
400000
300000
200000
100000
0
5
10
15
20
Hour of the Day


Accidents by Day of the Week
1e6
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Number of Accidents
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Day of the Week