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import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import plotly.express as px
import folium
from folium.plugins import HeatMap

# Load Dataset (adjust row limit for performance)
df = pd.read_csv("US_Accidents_March23.csv", nrows=5000)

# Quick Overview
print("Shape:", df.shape)
print("Columns:\n", df.columns)
print("\nMissing values per column:\n", df.isnull().sum())

# Drop columns only if they exist
cols_to_drop = ['Number', 'Wind_Chill(F)', 'Precipitation(in)', 'Nautical_Twilight']
df = df.drop(columns=[col for col in cols_to_drop if col in df.columns])

# Extract datetime parts
df['Start_Time'] = pd.to_datetime(df['Start_Time'], errors='coerce')
df['Hour'] = df['Start_Time'].dt.hour
df['DayOfWeek'] = df['Start_Time'].dt.dayofweek
df['Month'] = df['Start_Time'].dt.month

# Plot 1: Accidents by Hour
plt.figure(figsize=(10, 5))
sns.countplot(x='Hour', data=df)
plt.title("Accidents by Hour of Day")
plt.xlabel("Hour")
plt.ylabel("Count")
```

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plt.tight_layout()
plt.show()

# Plot 2: Accidents by Day of Week
plt.figure(figsize=(10, 5))
sns.countplot(x='DayOfWeek', data=df)
plt.title("Accidents by Day of Week (0=Mon, 6=Sun)")
plt.xlabel("Day of Week")
plt.ylabel("Count")
plt.tight_layout()
plt.show()

# Plot 3: Weather Conditions (Top 10)
if 'Weather_Condition' in df.columns:
    plt.figure(figsize=(10, 6))
    top_weather = df['Weather_Condition'].value_counts().nlargest(10)
    sns.barplot(y=top_weather.index, x=top_weather.values)
    plt.title("Top 10 Weather Conditions During Accidents")
    plt.xlabel("Accident Count")
    plt.ylabel("Weather Condition")
    plt.tight_layout()
    plt.show()

# Plot 4: Heatmap of Accident Locations (sampled for performance)
if 'Start_Lat' in df.columns and 'Start_Lng' in df.columns:
    df_geo = df[['Start_Lat', 'Start_Lng']].dropna().sample(n=300, random_state=42)

    m = folium.Map(location=[39.5, -98.35], zoom_start=4)  # USA center
    HeatMap(data=df_geo, radius=7).add_to(m)
    m.save("us_accident_hotspots.html")
    print("Heatmap saved as 'us_accident_hotspots.html'")
```

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else:
    print("Location columns missing, skipping heatmap.")
```