# Weather Data Analysis

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## Project Overview

This project focuses on analyzing weather data by visualizing temperature trends, rainfall distribution, and seasonal patterns using a generated weather dataset. The dataset contains daily temperature and rainfall data for an entire year. Various plots and statistical insights are derived to understand seasonal variations.

## Python Code for Weather Data Analysis

import pandas as pd  
import numpy as np  
import matplotlib.pyplot as plt  
import seaborn as sns  
  
# Generate a sample weather dataset  
np.random.seed(42)  
date\_range = pd.date\_range(start="2024-01-01", periods=365, freq='D')  
temperature = np.random.normal(loc=22, scale=5, size=len(date\_range)) # Simulated daily temperature  
rainfall = np.random.choice([0, 5, 10, 15, 20, 30], size=len(date\_range)) # Simulated daily rainfall  
  
# Create DataFrame  
df = pd.DataFrame({'Date': date\_range, 'Temperature': temperature, 'Rainfall': rainfall})  
  
# Extract Month and Season  
df['Month'] = df['Date'].dt.strftime('%b')  
df['Season'] = df['Date'].dt.month.map({  
 12: 'Winter', 1: 'Winter', 2: 'Winter',  
 3: 'Spring', 4: 'Spring', 5: 'Spring',  
 6: 'Summer', 7: 'Summer', 8: 'Summer',  
 9: 'Fall', 10: 'Fall', 11: 'Fall'  
})

## Temperature Trends Over Time

plt.figure(figsize=(12, 5))  
plt.plot(df['Date'], df['Temperature'], color='red', linewidth=1)  
plt.title("Temperature Trends Over Time", fontsize=14)  
plt.xlabel("Date")  
plt.ylabel("Temperature (°C)")  
plt.xticks(rotation=45)  
plt.grid(True, linestyle="--", alpha=0.5)  
plt.show()

## Monthly Rainfall Distribution

monthly\_rainfall = df.groupby("Month")['Rainfall'].sum()  
monthly\_rainfall = monthly\_rainfall.reindex(['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun',   
 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec'])  
  
plt.figure(figsize=(10, 5))  
plt.bar(monthly\_rainfall.index, monthly\_rainfall, color='blue')  
plt.title("Monthly Rainfall Distribution", fontsize=14)  
plt.xlabel("Month")  
plt.ylabel("Total Rainfall (mm)")  
plt.grid(axis='y', linestyle="--", alpha=0.5)  
plt.show()

## Seasonal Temperature Variations

plt.figure(figsize=(10, 5))  
sns.boxplot(x="Season", y="Temperature", data=df, palette="coolwarm")  
plt.title("Seasonal Temperature Variations", fontsize=14)  
plt.xlabel("Season")  
plt.ylabel("Temperature (°C)")  
plt.grid(True, linestyle="--", alpha=0.5)  
plt.show()