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# Exploratory Data Analysis - Time Series Analysis
# Student Name: Utkarsh
# Roll Number: <Your Complete Roll Number>

# Load necessary libraries
library(lubridate)
library(ggplot2)
library(forecast)
library(tseries)

# Load the dataset (replace 'path_to_your_file' with the actual path of the CSV file)
opsd_data <- read.csv("C:\\Users\\aryan\\Downloads\\opsd_germany_daily.csv")

# Convert 'Date' column to Date type
opsd_data$Date <- as.Date(opsd_data$Date)

# Handle missing values (remove or impute if necessary)
opsd_data <- na.omit(opsd_data)

# Numerical input based on the last 3 digits of your roll number
# Replace 123 with the last 3 digits of your Roll Number
Fname_Lname <- opsd_data$Consumption[1:123]

# Create a time series object for Consumption
consumption_ts <- ts(opsd_data$Consumption, start = c(year(min(opsd_data$Date)),
yday(min(opsd_data$Date))), frequency = 365)

# Plot the time series
png(filename="1.png")
ggplot(opsd_data, aes(x = Date, y = Consumption)) +
  geom_line(color = "blue") +
  labs(title = "Daily Electricity Consumption - <Your Complete Roll Number>", x = "Date",
y = "Consumption (MW)") +
  theme_minimal()
dev.off()

# Decompose the time series into trend, seasonal, and residuals
png(filename="2.png")
decomposed_ts <- decompose(consumption_ts)
plot(decomposed_ts)
dev.off()

# Perform ARIMA Forecasting
png(filename="3.png")
arima_model <- auto.arima(consumption_ts)
forecast_arima <- forecast(arima_model, h = 365)
plot(forecast_arima, main = "Forecast of Electricity Consumption - <Your Complete Roll
Number>", ylab = "Consumption (MW)", xlab = "Year")
dev.off()

# Perform ADF Test to check stationarity
adf_test <- adf.test(consumption_ts)
print(adf_test)

# Save the outputs and print the results in the console
summary(consumption_ts)
summary(forecast_arima)

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