## Question 5: Calculate Time-Based Toll Rates

import pandas as pd

from datetime import datetime, time, timedelta

def calculate\_time\_based\_toll\_rates(input\_df):

# Define time ranges

weekday\_time\_ranges = [(time(0, 0, 0), time(10, 0, 0)),

(time(10, 0, 0), time(18, 0, 0)),

(time(18, 0, 0), time(23, 59, 59))]

weekend\_time\_range = (time(0, 0, 0), time(23, 59, 59))

# Define discount factors

weekday\_discount\_factors = [0.8, 1.2, 0.8]

weekend\_discount\_factor = 0.7

# Initialize an empty list to store the modified rows

modified\_rows = []

# Iterate through each row in the input DataFrame

for \_, row in input\_df.iterrows():

for day in range(7): # Iterate over each day of the week (0 = Monday, 1 = Tuesday, ..., 6 = Sunday)

for start\_time, end\_time in weekday\_time\_ranges:

# Create datetime objects for start and end times

start\_datetime = datetime.combine(datetime.today(), start\_time) + timedelta(days=day)

end\_datetime = datetime.combine(datetime.today(), end\_time) + timedelta(days=day)

# Apply discount factor based on the time range

discount\_factor = weekday\_discount\_factors[weekday\_time\_ranges.index((start\_time, end\_time))]

modified\_row = row.copy()

modified\_row['start\_day'] = modified\_row['end\_day'] = (datetime.today() + timedelta(days=day)).strftime('%A')

modified\_row['start\_time'] = start\_datetime.time()

modified\_row['end\_time'] = end\_datetime.time()

modified\_row['vehicle'] \*= discount\_factor

modified\_rows.append(modified\_row)

# Apply weekend discount factor

start\_time, end\_time = weekend\_time\_range

start\_datetime = datetime.combine(datetime.today(), start\_time) + timedelta(days=day)

end\_datetime = datetime.combine(datetime.today(), end\_time) + timedelta(days=day)

modified\_row = row.copy()

modified\_row['start\_day'] = modified\_row['end\_day'] = (datetime.today() + timedelta(days=day)).strftime('%A')

modified\_row['start\_time'] = start\_datetime.time()

modified\_row['end\_time'] = end\_datetime.time()

modified\_row['vehicle'] \*= weekend\_discount\_factor

modified\_rows.append(modified\_row)

# Create a new DataFrame from the modified rows

result\_df = pd.DataFrame(modified\_rows)

return result\_df

# Example usage:

# Assuming df is your DataFrame created in Question 4

result\_df = calculate\_time\_based\_toll\_rates(df)