BA 875
Operations and Supply Chain Analytics
Homework Assignment 3 (Due 04/18)

Deliverable: Submit your homework assignment as a single Python Notebook only and clearly state your answer to each component of a question. Ensure to save Notebook with output shown. The delivery requirement has been stated here and in the HW submission portal. *You shall receive a 10 point reduction in grade if you do not submit in the format specified*.

Part I: Demand Unconstraining: Physical products with limited inventory
Dataset: grocery_data

You are given the same dataset of hourly sales rates of Pain de Boulogne shown in class and in the Python exercise (this data comes from Table 5.3 of textbook). Demand uncensoring for this dataset was applied using the proportional method in the Python exercise. Now, your assignment is to instead implement the other two methods, i.e., the DES and Averaging methods to arrive at the total estimated unconstrained sales values.

The two methods and their details are as follows:

a. Double Exponential Smoothing (DES) estimations

- Execute and report the same steps as seen in the companion code for the DES method on the Hyatt booking data
- Try (alpha,beta) = 0.1 to 1 using 0.1 increments and forecast. Assume a burn-in period of 3 hours.
- Step 1: Tease out the constrained booking curves
- Step 2: apply DES to the constrained curves; find best alpha and beta for each; predict
- Step 3: summarize total estimated demand for all booking curves as a column onto the original dataset and report the results. Failure to add results to original dataset and report will reduce points for Step 3

b. Averaging method estimations

- Execute and report the same steps as seen in the companion code for the Averaging method on the Hyatt booking data
- Since there is not a specific booking limit (as in the case of the booking data), you will be handling the last hour before censoring occurred each day when starting your prediction
- Step 1: slice booking curve into segments (in hourly increments)
- Step 2: Calculate unconstrained arrivals
- Step 3: Repeat algorithmic steps until you have reached final demand and report as a column onto the original dataset

c. Comparing DES and Averaging method results
    a. Comment on the meaning of the end numbers reported for both DES and Averaging method approaches (not the specific meaning for each number calculated, rather what the numbers are meant to represent). Also, offer an explanation for why the end numbers reported for both methods differ. Simply showing output of running code does not suffice for a response, provide an interpretation in your own words!

Part II: Demand Unconstraining: Service products with limited capacity
Dataset: booking_data

You are given the same dataset of booking demand data for the high fare at Hyatt Atlanta Downtown, which was shown in class and in the Python exercise. Demand uncensoring for this dataset was applied using the DES and Averaging methods in the Python exercise. Now, your assignment is to instead implement the other remaining method, i.e., the proportional method to arrive at the total estimated unconstrained booking values.

Implement the Proportional method to apply demand uncensoring to the Hyatt booking data

- Execute and report the same steps as seen in the companion code for the Proportional method on the hourly sales rates of Pain de Boulogne

- STEP 1: calculate the daily cumulative demand
    - In this case, the daily cumulative demand is already calculated. However, before proceeding to STEP 2, you will need to do any formatting/renaming of the columns, change any censored demand cases (in this scenario, instances of '25') to NaN values, and create a dataframe of the daily booking demand (as opposed to the daily cumulative demand).
- STEP 2: calculate the daily demand to cumulative demand ratio (r)
- STEP 3: calculate the average ratios for each day
- STEP 4: calculate R (cumulative/total) and Q (daily/total)
- STEP 5: summarize total estimated demand for all booking curves as a column onto the original dataset (unconstrained total demand = last unconstrainted cumulative demand / R ratio). Round all unconstrained total demand to nearest integer – ensure that the rounded numbers are reported your total estimated demand column.

- Comment on the meaning of the end numbers reported for the Proportional method approach (not the specific meaning for each number calculated, rather what the numbers are meant to represent). Simply showing output of running code does not suffice for a response, provide an interpretation in your own words!