OM 352, Fall 2023 **HW 4** **Assigned: 5 Oct. 2023**
Due: 11:59 PM, 11 Oct. 2023

Instructions: Each assignment will include a PDF file (like this one) with the assignment questions and an Excel file, with an Answers sheet and any data or models that we provide you with. You must download both the PDF and Excel files. You have to enter your answers in the Answers sheet of the same Excel file you have downloaded, then save and upload the Excel file. You must upload the same Excel file you downloaded. Further instructions are provided in the Online Assignment Tools Guide (see **Assignments** in eClass).

Put your answers in the appropriate cells (salmon-colored cells) in the **Answers** sheet. Use paste special … values to for all numerical answers. The other cells in the Answers sheet are locked, which means you won't be able to enter values into those cells. Do not change the format of cells in the Answers sheet. Save your file with the appropriate name and in the appropriate format ("HW#_ID.xlsx").

Marking will be based on the answers in the Answers worksheet of the file you upload. We will only look at the rest of the file if there is an appeal (and even then, the answers in the Answers sheet take precedence.) If you wish to appeal a mark, then the file you uploaded must include your supporting work for each question. It is a good idea to make one worksheet for each question.

Total points: 30, of which 2 points are for following the submission instructions provided above.

Planning for Flu Vaccination

Part 1: Forecasting

Every year around October, Alberta Health Services (AHS) provides free influenza vaccinations for Albertans. The number of Albertans that have gotten immunized against influenza for the last 13 flu seasons has been provided in "Flu" worksheet.

1. (4 pts.) Use Double Exponential Smoothing with LS = TS = 0.75 to forecast the number of Albertans that will get immunized against influenza in 2023-24. Also report the RMSE, based on the last four data points.

AHS can use this forecast information to determine how many vaccine doses they need for the next upcoming flu season.

Note: Do not round your numbers for this part.

Part 2: Monte Carlo Simulation

Let *D* ("demand") be the number of Albertans that will wish to get immunized against influenza in 2023-24. Let *Q* ("quantity") be the number of influenza vaccine doses that AHS orders for the 2023-24 season. AHS needs to order the vaccine before the season starts and cannot replenish its inventory once the season has started. Assume the following:

- *D* is normally distributed with mean = 1,250,000 and standard deviation = 350,000. These numbers are different from your answers to Question 1. [We give you these numbers so that all students use the same starting point for the remaining questions.]
- When simulating demand, round the demand to a whole number and convert it to zero if it is negative.
- AHS pays $50 for each dose that it orders.
- AHS incurs a disposal cost of $10 for every dose that is not used.
- AHS is considering three order sizes: *Q* = the mean of the demand, the mean plus one standard deviation, and the mean plus two standard deviations.
- There will be no cost of unmet demand.

The "RAND" worksheet provides 500 "frozen" random numbers generated with the RAND() function. Please use these random numbers in your work below. Set up your simulation model, in the "Simulation" worksheet, the way we have done in class:

- Put a model for 1 replication in the upper left corner of the worksheet
- Put the RAND()s from the "RAND" worksheet in the lower-right area
- Use VLOOKUP() to look up a RAND() for the current replication in the 1-replication model
- Put the replication results in the lower-left area, using a data table.

Here is some information to help you check your work:

- The simulated demand in Replications 1 and 500 is 1,032,206 and 818,090, respectively.
- If Q = 1,000,000, then the cost of ordering vaccine is $50,000,000 (for both replications 1 and 5) and the cost of disposing of unused vaccine in Replications 1 and 500 is $0 and $1,819,100, respectively.
- The number of people unable to get a vaccine dose ("unmet demand") in Replications 1 and 500 is 32,206 and 0, respectively.

2. (12 pts.) For Replications 150 and 425, report the simulated demand, the number of people unable to get a vaccine dose, the cost of ordering vaccine, and the cost of disposing of unused vaccine, for the three possible order sizes (Q= the mean of the demand, Q=the mean plus one standard deviation, and Q=the mean plus two standard deviations).

3. (12 pts.) Report the average and the sample standard deviation of the simulated demand, the number of people unable to get a vaccine dose, and the cost of disposing of unused vaccine, for the three possible order sizes based on the 500 replications. Also report the 95th percentile value of the number of people unable to get a vaccine dose and the cost of disposing of unused vaccine. [*Hint*: For calculating percentile, use the PERCENTILE.INC function.]