IE375 Fall 2020 Exercise Set I

1) Question from Section 1.4, Problem 7, 6th Edition

7. Consider the following fictitious industrial scenarios. In each case, identify the possible errors in strategy.
   a. A manufacturer of Winchester disk drives located in northern California is expanding the product line to include optical disks. Both products will be manufactured at the same facility even though the optical disks require a different process technology.
   b. A conflict has developed between the head of quality control and the vice president for operations at a tool and die manufacturer in the Midwest. The quality control manager has requested new die-casting equipment costing $400,000 that has an excellent reliability record, while the operations vice president has decided to purchase a similar product that is less reliable from another manufacturer for $300,000.
   c. The chief financial officer of a firm has established the policy of no new investments in facilities for the next year in order to improve the firm's current profitability profile.
   d. A microprocessor designed in the United States and produced in a plant in Mexico is used to monitor the pressure of fluids. It is sold both to an automobile manufacturer and to a maker of life-sustaining equipment.

2) Evaluate Reengineering Section 1.4 (Section 1.5, 6th Edition) and Just-in-Time Section 1.5 (Section 1.6, 6th Edition) with respect to Push-Pull strategy. How are these initiatives going to affect the pull-push boundary mentioned in class?

3) Question from Chapter 1 of your text-book (Problem 48 for 7th Edition).

45. Consider the following break-even problem: the cost of producing Q units, $c(Q)$, is described by the curve

$$c(Q) = 48Q[1 - \exp(-.08Q)],$$

where Q is in hundreds of units of items produced and $c(Q)$ is in thousands of dollars.

   a. Graph the function $c(Q)$. What is its shape? What economic phenomenon gives rise to a cumulative cost curve of this shape?
   b. At what production level does the cumulative production cost equal $1,000,000?
   c. Suppose that these units can be purchased from an outside supplier at a cost of $800 each, but the firm must invest $850,000 to build a facility that would be able to produce these units at a cost $c(Q)$. At what cumulative volume of production does it make sense to invest in the facility?

4) Question from Chapter 2 of your text-book **(**Section 2.4, Problem 8, both editions).

Discuss the following quotation from an inventory control manager: "It's not my fault we ran out of those parts. The demand forecast was wrong."

5) Question from Chapter 2 of your text-book**. (**Section 2.6, Problem 12, both editions)

A simple forecasting method for weekly sales of DVD drives used by a local computer dealer is to form the average of the two most recent sales figures.

Suppose sales for the drives for the past 12 weeks were

Week:	1	2	3	4	5	6	7	8	9	10	11	12
Sales:	86	75	72	83	132	65	110	90	67	92	98	73

a. Determine the one-step-ahead forecasts made for periods 3 through 12 using this method.
b. Determine the forecast errors for these periods.
c. Compute the MAD, the MSE, and the MAPE based on the forecast errors computed in part (b).

6) Question from Chapter 2 of your text-book (Section 2.7, Problem 22, both editions)

22. Handy, Inc., produces a solar-powered electronic calculator that has experienced the following monthly sales history for the first four months of the year, in thousands of units:

January	23.3	March	30.3
February	72.3	April	15.5

a. If the forecast for January was 25, determine the one-step-ahead forecasts for February through May using exponential smoothing with a smoothing constant of $\alpha = .15$.

b. Repeat the calculation in part (*a*) for a value of $\alpha = .40$. What difference in the forecasts do you observe?

c. Compute the MSEs for the forecasts you obtained in parts (*a*) and (*b*) for February through April. Which value of α gave more accurate forecasts, based on the MSE?

7) Question from Chapter 2 of your text-book **(**Section 2.9, Problem 34, both editions).

34. A popular brand of tennis shoe has had the following demand history by quarters over a three-year period.

1990	Demand	1991	Demand	1992	Demand
1	12	1	16	1	14
2	25	2	32	2	45
3	76	3	71	3	84
4	52	4	62	4	47

a. Determine the seasonal factors for each quarter by the method of centered moving averages.

b. Based on the result of part (*a*), determine the deseasonalized demand series.

c. Predict the demand for the first quarter of 1993 for the deseasonalized series from a six-quarter moving average.

d. Using the results from parts (*a*) and (*c*), predict the demand for the shoes for the first quarter of 1993.

e. Compare the result from part (*a*) with seasonal factors obtained by the simpler method described at the beginning of Section 2.9.

8) Question from Chapter 2 of your text-book **(**Chapter 2, Problem 56, both editions)

Lakeroad, a manufacturer of hard disks for personal computers, was founded in 1981 and has sold the following numbers of disks:

Year	Number Sold (in 000s)	Year	Number Sold (in 000s)
1981	0.2	1985	34.5
1982	4.3	1986	68.2
1983	8.8	1987	85.0
1984	18.6	1988	58.0

a. Suppose the firm uses Holt's method for forecasting sales. Assume $S_0 = 0$ and $G_0 = 8$. Using $\alpha = .2$ and $\beta = .2$, find one-step-ahead forecasts for 1982 through 1989 and compute the MAD and MSE for the forecasts during this period. What is the sales forecast for the year 2000 made at the end of 1988? Based on the results of 1988, why might this forecast be very inaccurate?

b. By experimenting with various values of α and β, determine the values of the smoothing constants that appear to give the most accurate forecasts.

Question 9) (A question on Forecasting and Inventory – You did not learn how to solve part c), yet!)

NER, Nesim Erkip's new restaurant, an establishment at Bilsehir, has a very steady number of customers each week. Hence, management of NER uses an exponential smoothing method with a smoothing constant of $\alpha = 0.2$ to forecast the demand for the number of meals served per week. The following numbers were observed during the previous four weeks: 185, 210, 200 and 195 say for D_1, D_2, D_3 and D_4, respectively (D_i stands for the demand in week i). Let $F_{0,1} = 200$ be the forecast of demand for week 1 at week 0, after observing the demand at week 0.

For all the computations keep one digit after the decimal point and use rounding.

a) Determine the forecast for week 5, given that you use the above information. Also compute the average absolute deviation estimated from the four weeks of observed demand. Even if you cannot compute call the forecast and call mean absolute deviation $F_{4,5}$ and $MAD_{1\text{-}4}$, respectively.

b) Assume that one napkin per meal is used. Suppose that the order lead time for napkins is 7 weeks. Fitting a normal distribution for weekly napkin demand of napkins is a reasonable approach. Find the mean and standard deviation of demand during lead time using the latest forecast information available, $F_{4,5}$ and $MAD_{1\text{-}4}$.

c) Assuming that napkin demand distribution during lead time has a normal distribution, what should be the reorder level for NER if NER uses a Type-1 service objective with probability of satisfying demand during replenishment set to be 0.9641? (You can define and use symbols for the answer of Part b), if you have no solution for it.)