IE 460 Comments on Homework #5

This homework problem is a variant of what I asked in HW#4. The answers are similar though there are some changes in the detail. So all the comments that I have made for HW#4 is valid here, as well. There are a few parts that might be considered towards the additional analyses mentioned in the comments of part f) in HW#4.

A few additional issues are added in this homework:

1) Correlation of demand within regions.
2) Lead time is no longer constant.
3) Truck capacity is a consideration.

There is a single question with a lot of details. The answers can be obtained from already available information in class and the textbook, and it does not require additional modeling. Note that when everything is stated as in the given problem, things look relatively simple, as in HW#4.

I will not repeat that you need to carry out all computations using the efficiency of the computer for a repetitive operation (either Excel or Python or similar).

The answers can be summarized as follows:

a) Different then the HW#4, lead times are stochastic, and you need to use another formula for the "standard deviation over the lead time" term. Note that SS computations will be similar as it uses the standard deviation term only. Here, also notice that you have non-identical regions and need to compute separately and add up for total. Total value of the SS for all regions is simply SS times the unit cost.

b) The last sentence is critical here. After centralization this may no longer be true – you might even have a reduction in the mean lead time and variability. The computation of the average service level is just to be consistent with part a) – nevertheless it is approximate. Reduction is SS is the decrease in SS for part b) as compared to part a). Your answer might be negative meaning that there is no decrease but an increase.

c) This part of the question investigates the relation between SS and CSL in the region of interest: Find the CSL value for which one will obtain the total SS level stated in part a). So, if we follow part c), we will not have a decrease in the total SS level, but an increase in the service level we give to the regions.

d) This part is a bit tricky, as you are not given sufficient information to carry out one set of calculations. (I would not do something like this in the exam – this is more like a case-type question.) Any consistent way of approaching will be accepted as the answer (actually, I will ask Shabnam not to consider this part while grading). It is important that you observe and understand the following:

   - ✓ The information given is insufficient to warrant a single solution to be correct.
   - ✓ CSL is a service level measure which does not claim anything with respect to the expected number of demands not satisfied on-time. Consider two cases with a

given CSL value: A large Q and a smaller one. If you have a large Q, it will result in a smaller number of cycles in a given time unit (year). Furthermore, this will result having a smaller expected number of backorders compared to a Q value which is smaller. Of course, this will result in a larger cycle stock.

- ✓ So, determining Q is also an optimization problem – of course this statement is under the assumption that there is a penalty cost for backorders. It does not exist in the problem statement.

I) Average order size in this case is not very clear. There are two likely ways to handle it:

- Consider ordering every period. So, the expected value of the order quantity is equal to the expected demand per month.
- Consider the Q,R model from IE375. Use the below information to come up with a Q* given CSL. Note that, as you do not know any value related to the cost of backorder, you may use EOQ as the value of the lot size or you can solve the three equations for three unknows: p, Q and R (which is expected lead time demand +SS). The three equations are alpha (CSL)I and the two optimality conditions. Both are reasonable.

(R,Q) Model

$$\alpha = \mathbf{F(R)} \qquad \beta = \mathbf{1-\frac{n(R)}{Q}} \qquad n(R) = E[\max(D - R, 0)] = \int_R^{\infty} (x - R) f(x) dx$$

To minimize cost, solve $Q = \sqrt{\frac{2\lambda [K + pn(R)]}{h}}$ **and** $1 - F(R) = \frac{Qh}{p\lambda}$

In either of the cases, you can find the associated transportation cost. Note that if the lot size used is greater than the capacity, then you need more than one truck to carry the load.

II) Repeat the same procedure with part d) I), now for the centralized system. Of course, you need to be consistent in how you come up with the Q value with the decentralized case.

III) Just find the difference for d)I) and d)II).

e) Shabnam, nothing to grade in this part, as well. Learn to discuss the following: Effect of a decrease in the correlation coefficient; effect of a possible decrease in the lead time with centralization; effect of a possible reduction in the variability of the lead time with centralization. (To learn – no obligation – you can do all the computations with excel and play with different parameters.) – This is not a question, of course. So, nothing is expected with respect to grading. This is what you would do if you were dealing with a real-life problem, as was discussed in the comments for HW#4.

Homework 5 statistics:

Average: TBA Standard Deviation: TBA

Grade	3	2	1	0
# of students				

Comments regarding your performance and grading:

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