IE 460 Spring 2019

Comments on Case 0

Case 0 statistics:

Average: 1.18, Standard Deviation: 1.01

Grade	3	2	1	0
# of people	6	6	16	11

Solution:

The case given to you is a representation of what you will see in real life. You may have simplistic assumptions to solve the problem – and then you relax some of those assumptions to make your problem more realistic. Nevertheless, it is important to solve it with simple assumptions first to see if you need to spend more time. In this problem, the outcome is very clear – the following comment summarizes the outcome (Note that this is one possible answer for Part c):

Air freight is the optimal shipping mode for smartphones. Even though shipping cost is cheaper by ocean transport, total cost increases because of the high inventory requirement if ocean shipping is used. In contrast, ocean freight is appropriate for decorative hardware because the lower cost of ocean transport more than compensates for any increase in inventory. In general, ocean freight is best used for heavier, low value, high demand, predictable product (like decorative hardware) while air freight is best used for lighter, high value, unpredictable demand product (like smartphones).

What were you expected to do? Here is the minimum desired:

- Compute batch size (Use EOQ if the environment described have costs available. In this case, the fixed costs were only available for ocean shipping – there were none for air freight. One can come up with an artificial fixed ordering cost using the minimum order quantity required).
- Compute cycle inventory (As a result you obtain cycle stock, compute the average cycle stock)
- Compute safety inventory (A service level, CSL is to be satisfied, indicating a certain multiplier of the standard deviation. To compute the standard deviation, you need to consider the randomness in the lead-time as well).
- Compute in transit inventory (When you are comparing transportation options, this term becomes critical. Note that this term is not a function of the previous inventory decisions,

as regardless how you order and how much safety stock you keep, you are expected to order the expected demand with every option.

- Compute average inventory (Check the below comment on the term "average")
- Compute annual holding cost
- Compute annual shipping cost (Note that this shipping cost is constant for Air Freight, but a function of how you order for Ocean Shipping.)
- Compute total cost.

This is the basic model. You can work on several extensions:

- Compute expected number of shortages implied by your alternatives.
  As an example, consider smartphones carried with air freight. The above steps will result in an optimal batch size of 833 units and the following shortage information, as well as average annual cost:

Exp. Shortage per replenishment cycle=	3.28
Exp. Number of Rep. Cycles per year=	62.45
Expected number of shortages per year:	205
TOTAL COST:	$227,110

  Now considering the fact that the minimum ordering quantity is what we should be ordering if we use air freight, then we will start a batch size of 500 units following shortage information, as well as average annual cost:

Exp. Shortage per replenishment cycle=	3.28
Exp. Number of Rep. Cycles per year=	104.00
Expected number of shortages per year:	342
TOTAL COST:	$214,635

  Note the following: If we increase the number of cycles during a time horizon, we are exposed to backorders more, and hence the expected number of shortages per year increases. Nevertheless, if we do not consider this change, the decrease in the batch size (and increase in the expected number of orders) will help us to reduce the observable inventory costs.

- Compute the imputed shortage cost using CSL and use it for cost comparison. This will be pretty sophisticated.

<u>Comments regarding your performance:</u>

General Comments:

When I compare your performance on Case 0 and Homework 1 and Homework 2, I realized that you can use the formulae once you figure out which formula you need. However, I was expecting your ability to analyze a complex system (identifying small, solvable parts) and

formulating it (choosing the right formula/framework) to be much better. That is why you can handle questions at the end of a chapter with some ease. However, your performance on a question which contains knowledge on three chapters turned out to be not as good. I strongly recommend you do the followings:

- Please understand why/when and under which assumptions do the authors of your textbook and Prof. Erkip think that a formula is useful. Unless you understand why/when you can use a formula or a framework, I believe matching them within more realistic (sometimes even complex) problems will be practically impossible. Additionally, understand formulae and hence the drawbacks of using it within a framework will enable you to further develop similar formulae (not necessarily rocket-science) and will make it easier for you to implement.
- Please read every sentence in a question carefully in order not to miss any details while presenting your solution.

Specific Comments:

- A number of you are making mistakes with respect to averages. Writing average cost means that the cost term is perpetual. Hence, it doesn't represent any time frame. To ease exposition, in the text book (and other texts, as well as in teaching) we consider computing the average over a given horizon (such as average cost per year, per week, etc). However, if the problem is a static one the average will be the same over different time horizons, as well. As an example think how we compute average inventory. We consider a time horizon (year, etc); compute <u>total</u> inventory carried in each cycle (area under the inventory curve); multiply that with the number of cycles in the selected time interval; finally divide the total to the length of the time interval. Note that this is the perpetual inventory – average inventory. We never multiply this average with a time length if we are charging a cost for the average.
- Some of you thought that the only inventory component is safety inventory and did not consider cycle and in-transit inventory. I believe making this mistake simply shows that you were not able to understand Chapters 12-14. Think about this: Cycle service level, the probability that demand is less than the inventory amount, should be 0.98. However, you suggest the <u>total</u> stock level determined in this way, and hence end-up with a quantity which is less than the mean demand. With this mistake only if your comments for *part c* were reasonable, you received 1 point. If your comments are also inconsistent with your findings in *parts a and b*, then you received 0 points. I believe this is not in contradiction with "effort" based grading – you should have the basics straightened.
- Some stated that in ocean shipping option, order amount should be equal to the container capacity without making any analysis. This is a serious mistake and those need to understand the trade off between transportation and inventory holding costs.

- The ones who found the total stock level by finding mean demand and safety stock or by finding EOQ and safety stock received 2 points.
- The ones who considered in-transit inventory as well and made elaborated comments received 3 points.
- You received 3 points if you tried to formulate the question in a creative way while presenting logical arguments which shows that you are consistent with the case and what you learnt in class. (e.g. adding backorder cost while arguing why you should add it as well as making derivations accordingly).