**Project 1**

Well Shield (WS) is a large distributor of face shields, N95 masks, and sterile gloves. In 2020, the COVID Pandemic has caused the demand for their products to sky rocket, leading them to need to rework their supply chain so they can meet the ever increasing demand. You have been asked to help WS with making these important design decisions. In all three legs of the project you will work with WS’s data to come up with different design recommendations that can help their supply chain managers meet these new challenges. In Part I, WS wants us to concentrate on deciding the inventory policies for their various regional warehouses. You can find the required data in the “well shield demand data.csv” data file. This file contains the recorded demand for each of the three products Well Shield distributes (masks, gloves, and face shields) over the past 20 weeks in each of the 30 service locations for WS.

(a) As a first pass, WS would like to use EOQ to get a sense for the order sizes. Compute the EOQ order size for each product at each warehouse, then compute the cycle time for each product and warehouse. Approximate the rate of demand for each product in each warehouse using the observations and utilize the following costs in your calculation:

Table 1: Production Costs for WS Products

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|  |  |  |  |
| --- | --- | --- | --- |
| Product Name | Fixed Cost | Variable Cost | Annual Holding Interest |
| Gloves | $125.00 | $1.00 | % 25 |
| N95 Masks | $250.00 | $20.00 | %22 |
| Face Shields | $120.00 | $10.00 | %20 |

(b)  Note that the demand for each product is in fact not deterministic, but fluctuates from period to period. On average the lead time from each supplier to the warehouses is 1 week. Using a 99.9% Type II service level, compute the appropriate order quantity and reorder point for each product at each warehouse. What are the new expected cycle times for each warehouse? (HINT: you may assume demand is normally distributed with a mean equal to the sample mean, and standard deviation equal to the sample standard deviation)

(c)  Suppose instead of using the exact Type II policy, WS decides that to simplify decision mak- ing they would like to use the Type II heuristic. Using the same costs and lead time as in the previous part, compute the new order quantities and reorder points for each product at each facility. What is the relative difference in terms of both the total expected logistics cost and safety stock levels between the heuristic policy and the policy from the previous section?

(d)  In each of the previous scenarios, we have allowed each product to arrive at a different point in time to the warehouse (i.e. they each have different cycle times). In practice WS would find this very challenging to manage their warehouse personnel, so they would like us to synchronize the order deliveries. One way to do this is to shift from continuous to periodic review based on our lead time. For this scenario, let us consider a periodic review policy where order placement is evaluated at the beginning of the week. All other costs will be the same except for fixed cost which will now be fixed to a single lower value of $100 for each product. As computing the true (S,s) for this scenario is challenging, compute an approximate policy that has both an order up to point S and reorder point s. We would still like to maintain a Type II Service level of 99.9%.