Case 4 --

Good news …

You are hired as the Executive Distribution Manager (EDM) of The City Distribution Co. (CDC)

Job background …

After the first two days of warming up, the General Manager described you the background information related to your job …

Current system:

- The EDM needs to replenish the CDC’s inventory (in Central Warehouse) from a single supplier and fill the orders of three retailers for a particular product
- Data
  - Daily demand at retailers are independent and $d_1,d_2,d_3 \sim U[0, 80]$.
  - The lead time (or Transit Time, including ordering process and shipping) between the supplier and warehouse ($LT_{sw}$) is 3 days, and between the warehouse and all retailers ($LT_{wr}$) is 2 days.
  - The continuous review policy is used by both CDC (to replenish its inventory from the supplier) and the three retailers (to place orders from the CDC). The inventory policy for the CDC is $(r, Q)_{sw} = (300, 250)$ and for the retailers, $(r, Q)_{wr} = (12, 90)$.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>LT_{sw}=3 days</th>
<th>C.W. at CDC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(r, Q)_{sw} = (300, 250)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LT_{wr}=2 days</th>
<th>Retailer 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$d_1$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LT_{wr}=2 days</th>
<th>Retailer 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$d_2$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LT_{wr}=2 days</th>
<th>Retailer 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$d_3$</td>
</tr>
</tbody>
</table>
Improve the system – Your job!!

- Owing to the high inventory cost at the CDC, and as well the unsatisfactory fill rate, the CDC has recently taken the new initiative to set up the VMI system with the three retailers. Under the new VMI system, the EDM at the CDC takes the additional responsibility of monitoring POSs and inventory level at retailers and auto-replenishing their inventories.

- Your job is to design (by using a simulator – called The Distribution Game) the best possible inventory policy for the new VMI system. Although the general objective of the policy setting aims to maximize the satisfaction of demand (the fill rate) and minimize its inventory cost, as a start, the company requires you to identify the policy that performs better than or at least as good as the current policy (system) during a 100-days (or more) period operation. The final policy performance measure is given by:

\[ \text{Performance} = \text{Fill Rate} \times \text{Net Profit}_{100\text{-day}} \]

Let’s start – Assignment #4

Part A: Simulate the performance of current system

- Download the file for The Distribution Game from the course web

**Step 1:**
- To simulate the performance of current system (policy), choose and start DISTGAME ( ).
- You should see the screen shown below:
- Click **File** , choose **Open** ..., and select: REVISED1.PRM (Don’t use Default.prm !!!)

**DecisionBox1:** to input the your order to Supplier to replenish CW

**Inventory level at the CW of the CDC (Initial level = 120)**

**Current Inv. level at retailer 1, 2 and 3**

**DecisionBox2, 3, 4:** to input the allocated amount for each retailer
Step 2:

Choose Game 2 from in the top menu bar.
(Noticing that the boxes indicating the inventory levels of the three retailers disappeared in the screen shown in the right. As in the current system the retailers make the decision of how much to order and the EDM at the CDC -- you, can NOT see the retailers’ inv. before they reach the retailers’ reorder point, 12. However, once the inventory level of at an retailer site drops to or below its reorder point, r=12, the box appears and the negative value shown in the box indicate the shortage, and the positive value shown indicate the inventory level that is below 12.)

Step 3: -- Place orders

Follow the given the continuous review policy to place orders at the DecisionBox 1-4.

- $(r, Q)_{SW}=(300, 250)$ – the EDM order from the Supplier
- $(r, Q)_{WR}=(12, 90)$ – the retailers order from the CW

Click to advance to the next day.
(Note the trucks take LTSW and LTWR days to complete shipping)

Step 4:

Continue the step 3 until the number of days reaches 100 in the upper right corner of the screen, Then Stop.

Step 5: Obtain the performance statistics from the 100-days run

Choose Show Stats from in the top menu bar

Use print screen function to obtain the following three figures (-- A must !!)

- (1) Statistics; (2) Cost report; and (3) Cumulative Plot
  (-- Refer to the Appendix or ask the TAs for the interpretation of the figures.)

Calculate and record the final performance measure:

$$\text{Performance Measure} = \text{Fill Rate} \times \text{Net Profit}$$

(Note: to know the performance of 100-days run, one should repeat the simulation for a reasonable number of times and then take the average result. As the exercise here, you could only run 100-days once.)
Part B: Design the new inventory policy

Identify

(1) a Continues Review Policy \((r, Q)^*_{WR}\) and 
(2) a Periodic Review Policy \((T, OUL)^*_{WR}\)

to replenish the retailers’ inventory in the new VIM system. The final performance measure -- \((\text{Fill Rate})(\text{Net Profit})\) of the new system MUST be better than or at least as good as the one from Part A, i.e. the current system

- In Step 1, do the same as in Part A.
- In Step 2, Choose Game 1 from \(\text{Green}\) in the top menu bar.
- In Step 3,
  - apply the policy \((r, Q)_{SW}=\{300, 250\}\) when order from the Supplier for the CW, and
  - determine and apply your continuous review policy \((r, Q)^*_{WR}\) to replenish for the retailers
- Step 4 & 5 are the same as in Part A.

- Repeat the above process and determine your periodic review policy \((T, OUL)^*_{WR}\) in Step 3.

(Note: you may need to try a number of runs to find your policies that perform better than the current system.)

Part C: Summarize and Discussion

1) Summarize and compare
   - The performance of current system:
     \(\{(r, Q)_{SW}=\{300, 250\}, (r, Q)_{WR}=\{12, 90\}\}\)
   - The performance of the new VMI system with your continuous review policy:
     \(\{(r, Q)_{SW}=\{300, 250\}, (r, Q)^*_{WR}\}\)
   - The performance of the new VMI system with your periodic review policy:
     \(\{(r, Q)_{SW}=\{300, 250\}, (T, OUL)^*_{WR}\}\)

2) Discuss the advantages and disadvantages of each system above
3) Discuss any possibilities to further improve the new VMI system reported above. Justify your argument
4) Point out the unrealistic areas in the assignment setting and provide some clues how should you cope with the reality
5) Brief what you have learnt from this case.
Remarks:

- The lead time (or Transit time), $LT_{SW}$ and $LT_{WR}$ are fixed as 3 and 2 days, respectively.
- You can view all the parameter and cost settings by choosing View Parameters from the menu bar in the top menu bar. (Note: you are not allowed to change or edit the settings)
- You may get help by clicking Help or read Appendix file from the web.