Module 11 – EOQ

Exploratory Data Analysis

In this section, you should perform some data analysis on the data provided to you. Please format your findings in a visually pleasing way and please be sure to include these cuts:

- *Make line graphs showing the following data over time:*
  - *Sales*
  - *Unit Purchase Cost*
  - *Fixed Order Cost*

- *Use a forecast method to determine annual demand for 2025 to use for our model*
  - *Naïve*
  - *Moving Average / Weighted Moving Average*
  - *Linear Regression*
  - *Exponential Smoothing*
- *For costs, use a similar/different method. Otherwise, a simple overall average is fine.*

Model Formulation

Write the formulation of the model into here prior to implementing it in your Excel model. Be explicit with the definition of the decision variables, objective function, and constraints. Please restate the variables in the algorithm (i.e. D = Annual Demand)

Total Annual Cost: D*C + (D/Q)*S +(Q/2)*C*i

- **D** = annual demand for the item
- **C** = unit purchase cost for the item
- **S** = fixed cost of placing an order
- **i** = cost of holding inventory for a year (expressed as a % of C)
- **Q** = order quantity

Model Optimized for Minimizing Costs with Optimal Order Quantity
Implement your formulation into Excel and be sure to make it neat. This section should include:

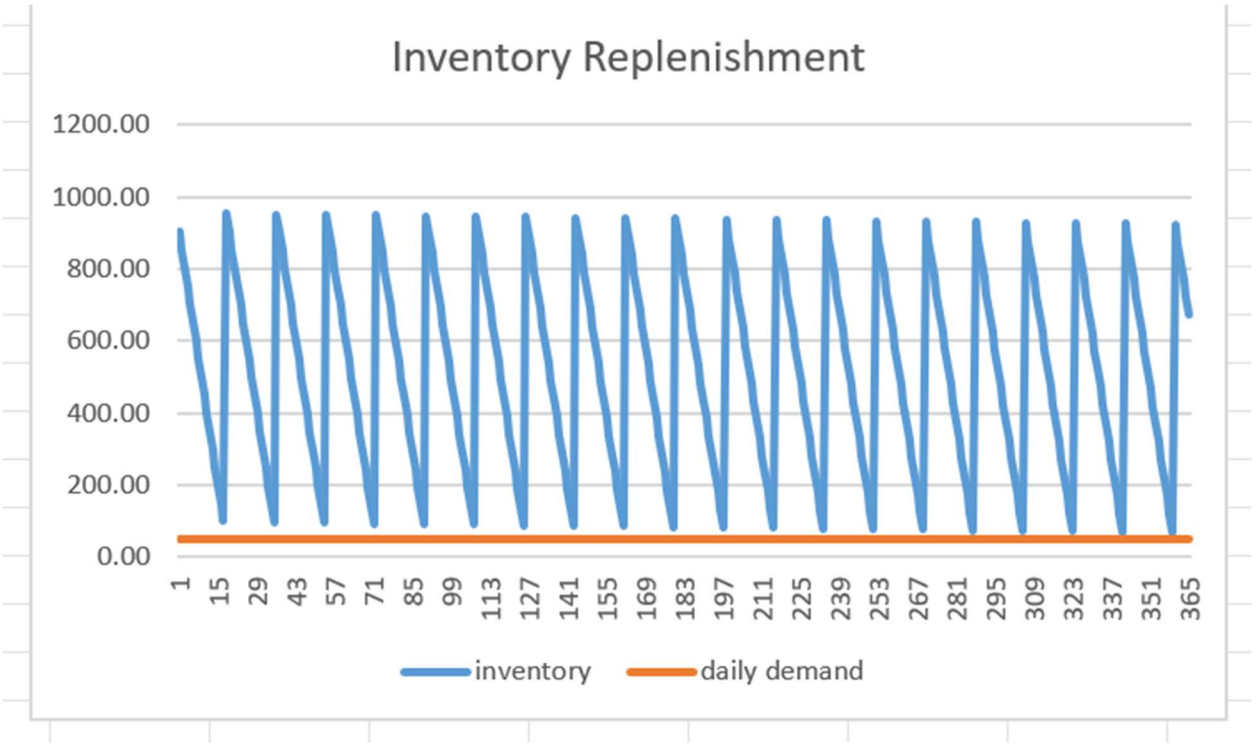
- *A screenshot of your optimized final model (formatted nicely, of course)*

D	**Annual Demand**	**18374**		
C	**Cost Per Unit**	**$44.03**		20.31371
S	**Cost per Order**	**$186.25**		
i	**Holding cost**	**19%**		
Q	**Order Quantity**	**904.51**		
	Purchasing Cost	**$809,004.87**		
	Cost of ordering	**$3,783.43**		
	Inventory cost	**$3,783.43**		
	Total Cost	**$816,571.73**		

- *A text explanation of what your model is recommending*

  My model is recommending that we order approximately 905 units every time that we order. This is because we would minimize costs with our holding cost being 19% and or order cost being $186. If we order more frequently, our costs will go up because it costs us $186 per order we make and an additional $44 per unit per order. With this our total cots would be around $817,000 per year.

- *Make a "sawtooth chart" for 2025, see below for reference. Assume you start with year with your EOQ Quantity like it has below*



Model with Stipulation

Please copy the tab of your original model before continuing with the next part to avoid messing up your original solution.

Implement the below EOQ extension, EOQ with planned backorders. We have added 2 new variables: A = shortage cost & b = planned back orders. Restate the previous variables with these new ones please. Note, you'll need to solve for both Q and b* here to get the optimal solution. You should start Q out as the EOQ from the previous section and b as 0. Also, note that this algorithm does not include `D * C` as it's not relevant to this analysis*

D	**Annual Demand**	**18374**
C	**Cost Per Unit**	**$44.03**
S	**Cost per Order**	**$186.25**
i	**Holding cost**	**19%**
A		**22**
Q	**Order Quantity**	**1062.66**
b	**Planned Back Orders**	**292.7598227**
2nd thing	**Carring Cost**	**$2,333.16**
D/Q*S	**Cost of ordering**	**$3,220.37**
third thing	**Planned Back orders**	**$887.20**
	Total Cost	**$6,440.73**

$$\text{Total Relevant Cost} = \frac{D}{Q}S + \frac{(Q-b)^2}{2Q}C_i + \frac{b^2}{2Q}A$$

Lastly, do the following:

- *Explain why you may include planned backorders (i.e. plan to accept purchases when out-of-stock such that some customers will wait for their purchase). Please think critically prior to doing any searches for why*

  We might want to plan for backorders because if an order is placed and we don't have the inventory on hand, we can fill the order after we have received the inventory. This means that we can receive an order, and fill it once we received all of the inventory.

- *Make a similar "sawtooth chart" with the results here. Note, it will be very similar as before, but inventory will go below 0 before replenishing*