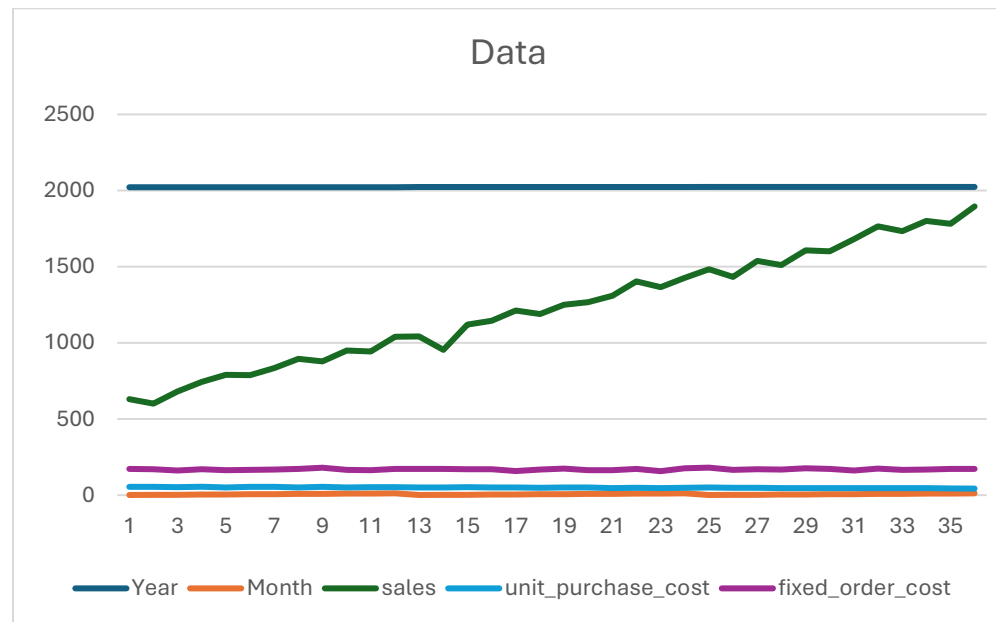


# Module 11 – EOQ

## 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.*

	<b>Annual Demand 2025</b>	
	<b>NAÏVE</b>	\$ 19,833.00
	<b>Overall Average Fixed cost</b>	\$ 170.44
	<b>Overall Average unit cost</b>	\$ 46.46

### 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)

$$\text{MIN: } DC + (D/Q)S + (Q/2)Ci$$

Subject to:  $Q \geq 1$

Annual Demand : \$19,833

Cost per Unit: 46.46

Cost per order: 170.44

Holding Cost: 19%

Quantity: 875.19

$$\text{MIN: } 19,833 * 46.46 + (19,833 / 875.19) 170.44 + (875.19 / 2) 46.46 * 19\%$$

### Model Optimized for Minimizing Costs with Optimal Order Quantity

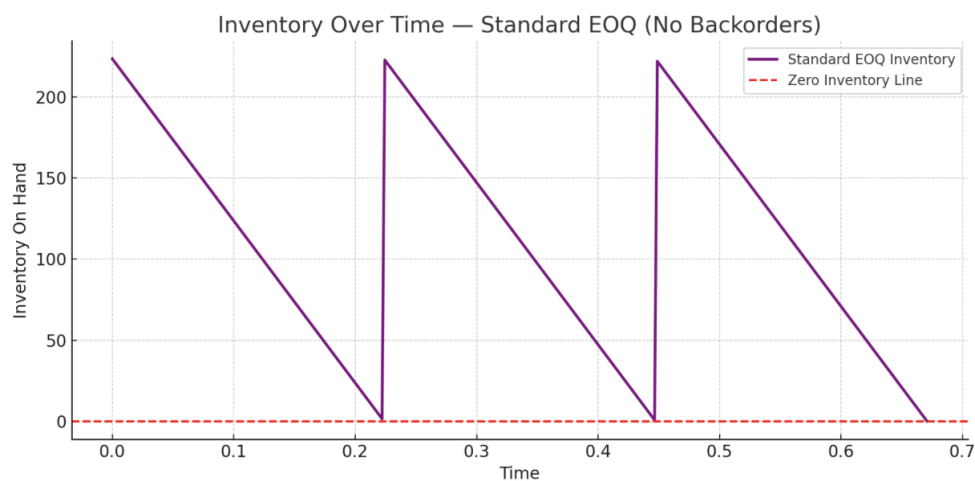
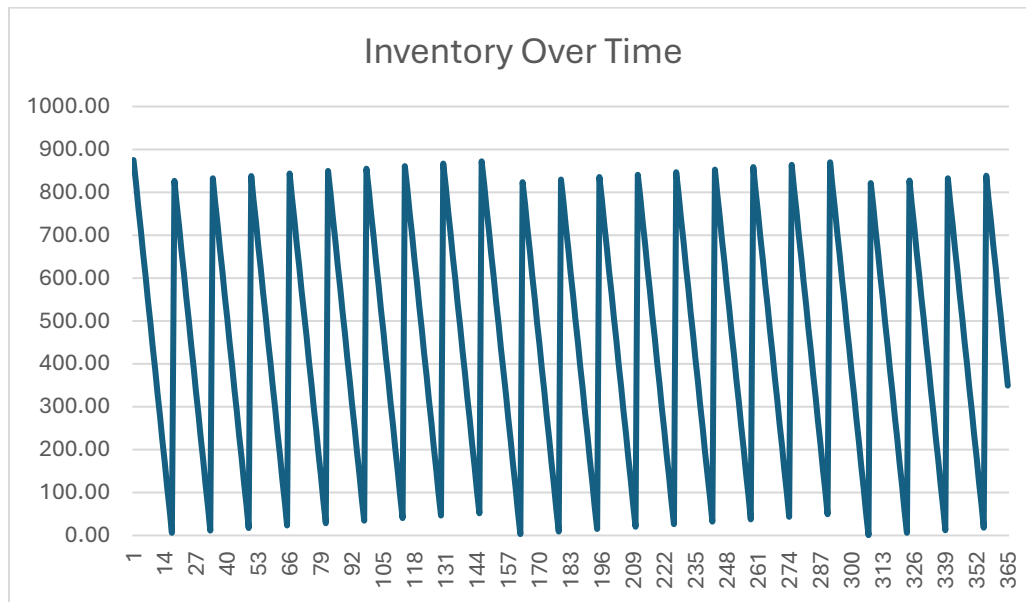
Implement your formulation into Excel and be sure to make it neat. This section should include:

- A screenshot of your optimized final model (formatted nicely, of course)
- A text explanation of what your model is recommending
- Make a "sawtooth chart" for 2025, see below for reference. Assume you start with year with your EOQ Quantity like it has below

				DAILY
D	Annual Demand	\$	19,833	\$ 54.34
C	Cost per Unit	\$	46.46	
S	Cost per Order	\$	170.44	
i	Holding Cost		19%	
Q	Order Quantity		875.19	
	Purchasing Cost	\$	921,351	
	Cost of Ordering	\$	3,862	
	Inventory Cost	\$	3,862	
	Total Cost	\$	929,076	

## Valeria Santoni

- The model recommends an order quantity (Q) of 875.19 units, based on the Economic Order Quantity formula, which helps determine the optimal number of units to order in each batch in order to minimize the total cost associated with inventory management. This quantity minimizes the combined costs of ordering and holding inventory.



### Model with Stipulation

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

## Valeria Santoni

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

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

				DAILY
$D$	Annual Demand	\$	19,833	\$ 54.34
$C$	Cost per Unit	\$	46.46	
$S$	Cost per Order	\$	170.44	
$i$	Holding Cost		19%	
$A$	Shortage Cost		20	
$b$	Planned backorders		321.7221855	
$Q$	Order Quantity		1050.71	
	Cost of Planned Backorders	\$	985	
	Cost of Ordering	\$	3,217	
	Inventory Cost	\$	2,232	
	Total Cost	\$	6,434	

**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. planned backorders.**

- It allows businesses to better manage inventory levels, reduce holding costs, and maintain sales during stockouts, all while satisfying customers who are willing to wait for their purchases. This approach improves cash flow, inventory turnover, and customer loyalty in the long term. For products with seasonal demand, or for limited-edition items that tend to sell out quickly, planned backorders can help manage spikes in demand. Also, A business can use the capital that would have been tied up in holding inventory for other areas of operation.

**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**

