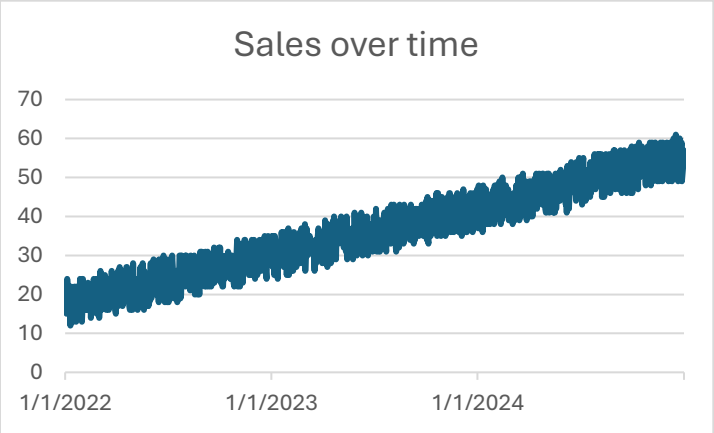
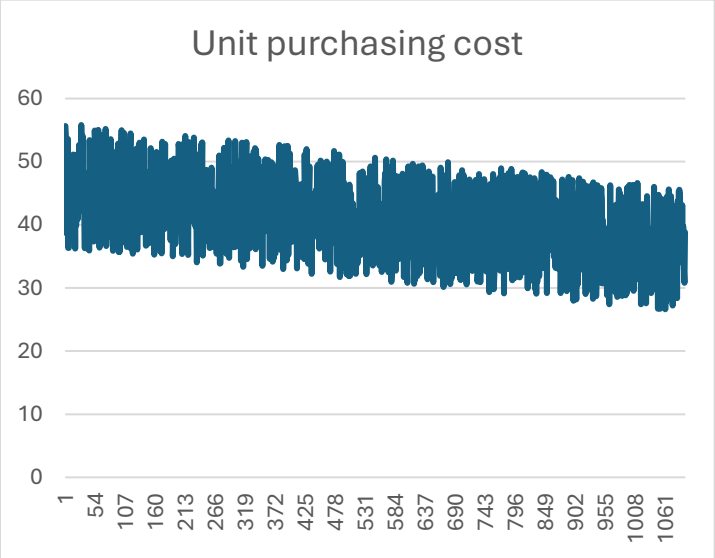
Module 11 – EOQ

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= DC+(D/Q)*S+(Q/2)Ci
Constraint: Q>=1

Where D=Annual Demand
C= Average Purchase Cost
S= Fixed Order Cost
I= Holding Cost
Q= Order Quantity

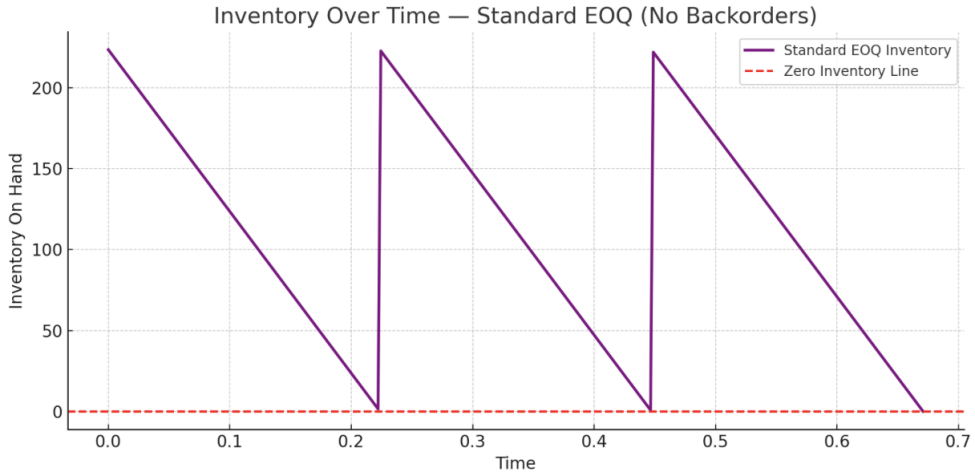
Model Optimized for Minimizing Costs with Optimal Order Quantity

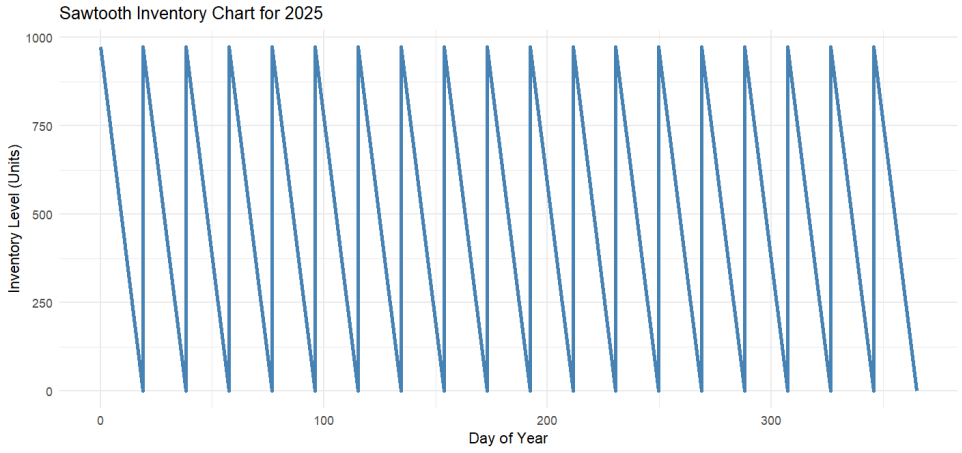
Implement your formulation into Excel and be sure to make it neat. This section should include:

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

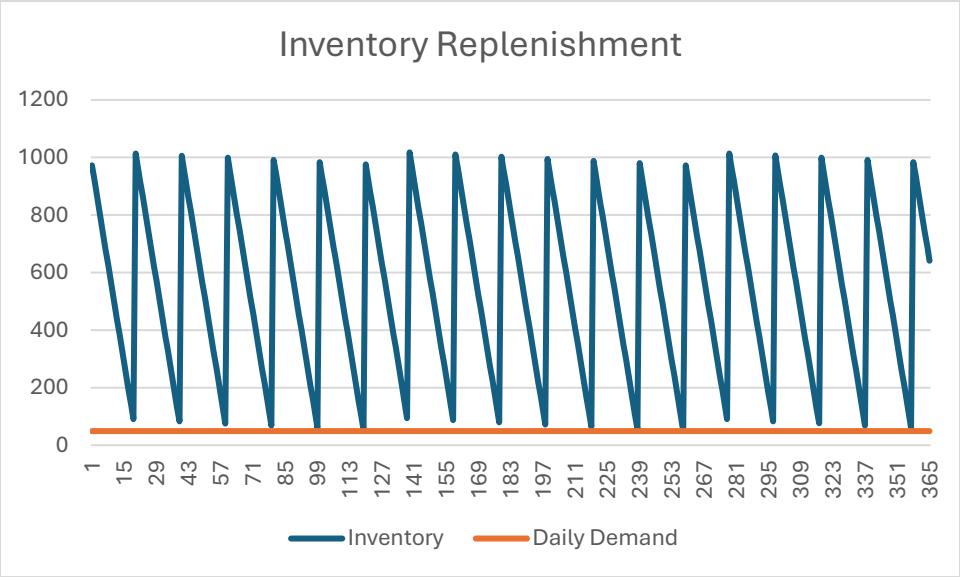
D	**Annual Demand**	**17,882**
C	**Purchase Cost**	**$41**
S	**Fixed Order Cost**	**$195**
i	**Holding Cost**	**18%**
Q	**Order Quantity**	**972.3287**
	Purchasing Cost	$731,731
	Cost of Ordering	$3,581
	Inventory Cost	$3,581
	Total Cost	**$738,893**

This model recommends ordering 972 units at a time using the Economic Order Quantity (EOQ) formula to minimize total inventory costs. It balances the cost of placing orders and holding inventory, resulting in an annual total cost of $738,893, which includes purchasing, ordering, and inventory holding costs.





Or I did this one too



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*

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

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*
- *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*

D	**Annual Demand**	**17,882**
C	**Purchase Cost**	**$41**
S	**Fixed Order Cost**	**$195**
i	**Holding Cost**	**18%**
A		22
Q	**Order Quantity**	697.64063
b	**Planned Back Orders**	453.71085
	Carrying Cost	$1,745
	Cost of Ordering	$4,991
	Inventory Cost	$3,246
	Total Cost	**$9,982**

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

A	22

When running a business, it's important to have planned backorders so that you can properly forecast your demand when out of stock. This helps better plan the demand for next months. Also, it can be something you want to do when demand for a specific product is high, and you know customers will wait for it. Also, this only works when demand is predictable.