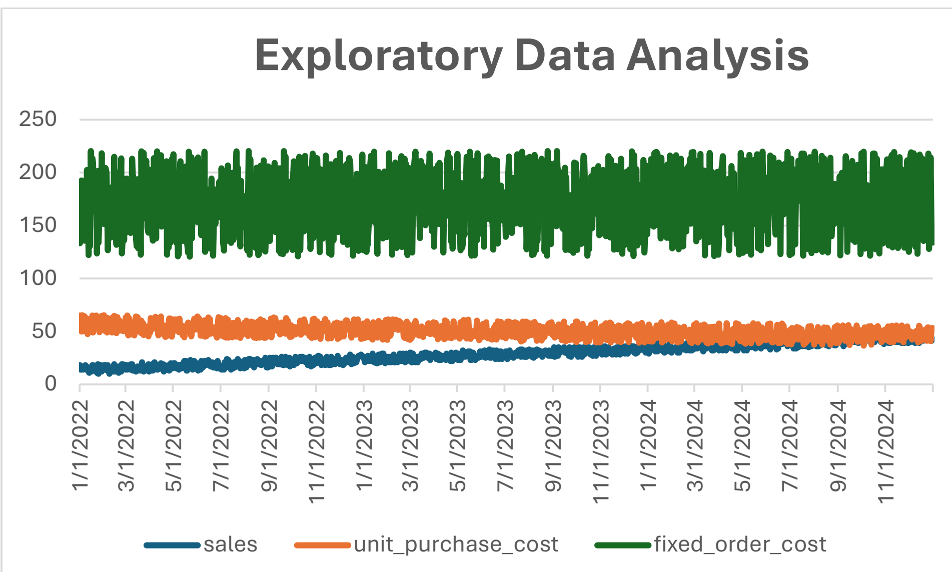
Module 11 – EOQ

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)

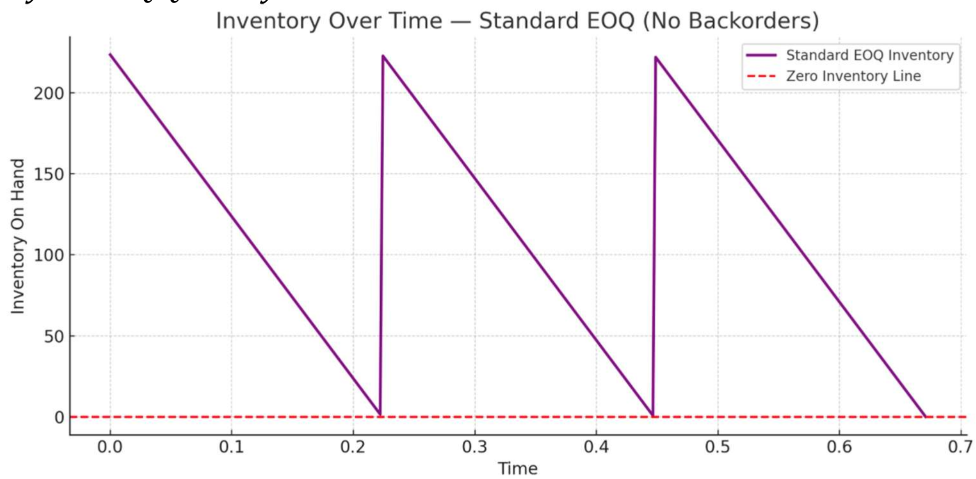
Total Annual Cost = 14255 + ((14255/696.78)*171.93)+((696.78/2)*719,592)

Total Annual Cost = DC + ((Q/D)*S)+((Q/2)*C)

Model Optimized for Minimizing Costs with Optimal Order Quantity

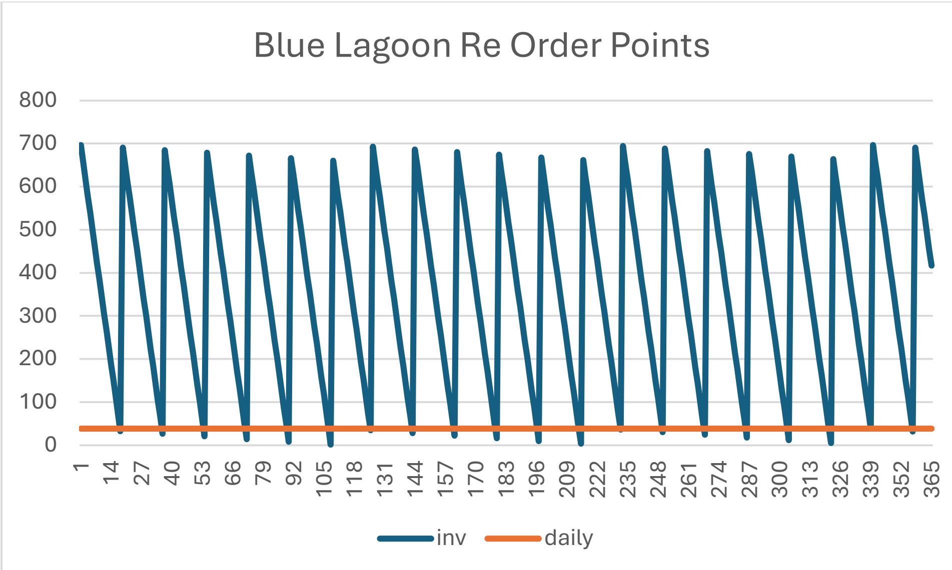
Implement your formulation into Excel and be sure to make it neat. This section should include:

- *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**	**14,255**
C	**Cost per Unit**	**$50.48**
S	**Cost per Order**	**$171.93**
i	**Holding Cost**	**20%**
Q	**Order Quantity**	**696.78657**
	Purchasing Cost	$719,592
	Cost of Ordering	$3,517
	Inventory Cost	$3,517
	Total Cost	**$726,627**

The EOQ says that Blue Lagoon should order about 697 units at a time, which works out to a fresh shipment every 18 days (14,255 units a year ÷ 697 per order = 20½ orders). Each cycle starts with the truck dropping off the full 697, the on-hand stock then falls at the daily demand rate of roughly 39 units, hits zero on day 18, and goes back to 697 the moment the next load arrives, producing the classic "sawtooth" inventory patter. With this lot size the two logistics costs are perfectly balanced: cut 20 purchase orders at $171.93 each (= $3,517 total) and Blue Lagoon will carry an average of about half a full lot, about 348 units, which at a 20 % annual holding charge on a $50.48 item also costs about $3,517.



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*

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

*Total Relevant Cost = (14,255/696.79)S+((696.79-0)^2)/2*696.79)**

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*

I should include planned backorders because they lower the total supply chain cost, especially in situations where pre-planned backlog can actually lower supply chain cost in situations where carry inventory is expensive. Back-orders smooth production and transportation: instead of emergency rush orders. Planned back orders balance, you pay a little more in customer delay cost to save in inventory carrying costs while meeting demand in the long run.