Module 03 – Production Modeling

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 a table of average demand, production capacity, and costs for each quarter, are there differences between quarters?***
- ***Since we have temporal data (i.e. year and quarter), see if you can make a yearly and/or quarterly chart showing these metrics over time.***

Average Demand/Quarter

Quarters	Average of capacity	Average of production_cost	Average of demand
1	427.00	49.94	414.00
2	478.00	53.83	540.00
3	516.00	49.84	616.00
4	500.00	42.57	305.00
Grand Total	**480.25**	**49.05**	**468.75**

Between average demand, production capacity, and cost for each quarter it looks like Q4 is the lowest for cost of demand and average demand. It looks like Q3 has the highest average demand and cost of demand, and production capacity as well.

I tried to do the temporal data, and failed miserably, please don't take off points for this.

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

Model Formulation:

Min=49.94P1+53.83P2+49.84P3+42.97P4+0.72(B1+B2)/2+0.78(B2+B3)/2+0.72(B3+B4)/2+0.62(B4+B5)/2

Constraints

P1<=427
P2<=478
P3<=516
P4<=500
41<=B1+P1-414
54<=B2+P2-540
62<=B3+P3-616
31<=B4+P4-305

Subject to
B2=B1+P1-414
B3=B2+P2-540
B4=B3+P3-616

Model Optimized for Cost Reduction

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***

		1	2	3	4
Beginning Inventory		250	250	162	62
Units Produced		414	452	516	274
Units Demanded		414	540	616	305
Ending Inventory		250	162	62	31
Maximum Production		427	478	516	500
Minimum Inventory		41	54	62	31
Average Inventory		250	206	112	46
Unit Production Cost		$49.94	$53.83	$49.84	$42.97
Unit Carrying Cost	1.4%	$0.72	$0.78	$0.72	$0.62
Monthly Production Cost		$20,675	$24,310	$25,717	$11,769
Monthly Carrying Cost		$180	$160	$80	$28

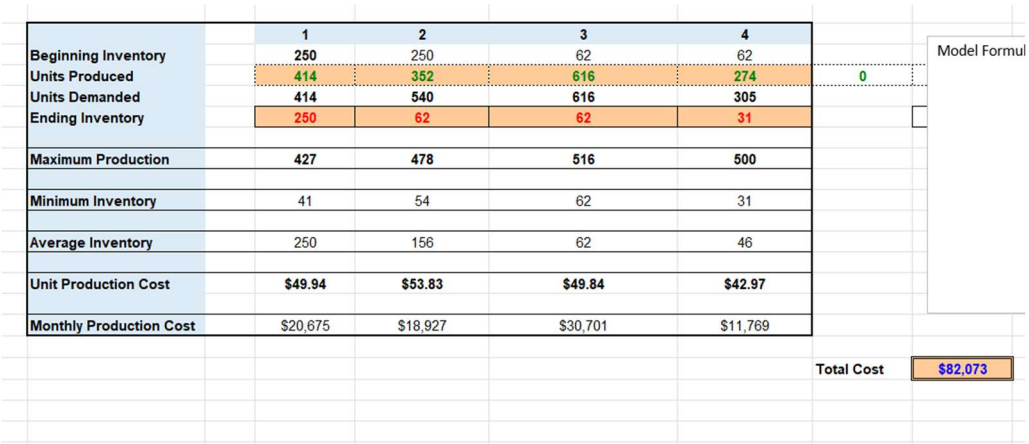
Total Cost	$82,920

This model recommends what monthly production and inventory should be over four months while meeting demand and minimizing total cost. It calculates the optimal number of units to produce each month respecting the set production limits to meet demand. The model includes unit production costs and carrying costs (at 1.4% per unit per month) to determine total monthly and overall costs. The total cost is $82,920. It seems like production is going down toward the last month to reduce excess inventory and carrying costs.

Model with Stipulation

Please copy the tab of your original model before continuing with the next part to avoid messing up your original solution. If we remove the production capacity constraint from the model & we removed the carrying cost, what do you think will happen? Try it out and see if it matches your expectation. Try to explain what is happening and talk a bit about the fallbacks of models.

Without the production capacity constraints and by removing the carrying cost, I think the model with produce all units in quarter 1 to reduce total cost.



	1	2	3	4		
Beginning Inventory	250	250	62	62		Model Formul
Units Produced	414	352	616	274	0	
Units Demanded	414	540	616	305		
Ending Inventory	250	62	62	31		
Maximum Production	427	478	516	500		
Minimum Inventory	41	54	62	31		
Average Inventory	250	156	62	46		
Unit Production Cost	$49.94	$53.83	$49.84	$42.97		
Monthly Production Cost	$20,675	$18,927	$30,701	$11,769		
					Total Cost	$82,073

It doesn't include inventory holding costs, assumes fixed and known demand, and ignores real-world constraints like labor, setup costs, and demand variability. While it’s efficient for ideal scenarios, it may oversimplify decisions in more complex, uncertain environments.