

BUS1942 B - Business Analytics. Spring 2022

Module 4: Nonlinear Optimization - Case

Note: This case should be solved in teams of 3, 4 or 5 members. You should present your work progress at the end of today's session, and then submit the final work according to the deadline shown at the end of the problem. One submission per team will be enough as long as all members names are included.

Note 2: If you decide to discuss with other teams, please indicate which teams participated in the discussion.

Case - Your new job!

We are two years in the future from today. After years of hard work in college, you have decided to search for a job in the Business Analytics field. You did some research and learned that working as a management scientist (or operations research specialist) is one of the jobs with higher salaries in the US (see: <https://money.usnews.com/careers/best-jobs/operations-research-analyst/salary>). After checking different career options, you have found the following job opportunity: Production manager at SunFlora, a major solar panels producer.¹

Job Description: SunFlora is a leading company in the production of solar panels at one of the factories in California. The duties of the selected applicant are the followings:

- a) Make sure the demand for solar panels are satisfied in the following quarters;
- b) Communicate with the department sales and marketing to know what would be the solar panels demand the following quarters;

¹Elaborated by the instructor

- c) Communicate with the customer service department to make sure all customer complaints are satisfied.

Job salary: \$95,560

Days of work: Remote work Monday to Wednesday. Work at the plant Thursday and Friday

—A conversation during the first week of work—

We know the solar panel market has been growing really quick in the past years, and some people are very anxious about the delivery times due to high demand. Some of the new customers needed to wait weeks or even months until the solar panels were completely installed in their houses. Some customers were not willing to wait and decided to go with the competitors (which have lower quality and efficiency, by the way). We needed to check our forecasts from the marketing and sales department and adjust them so this time we don't face that situation and lose customers again! We have captured the sales data for our solar panels and it is available for you to analyze it in the file *BUS2-194B_NLO-Case-Data.xlsx* (check *instruction b*)).

We trust that the new model for forecasting will be very good and we don't need to worry about inaccurate forecasts anymore, but we need to use those forecasts to make sure we produce enough solar for the coming 4 quarters.

The production capacity is 45 thousand solar panels per quarter. Nevertheless, a subcontractor can be hired to have an extra capacity of 10 thousand solar panels per quarter, but that will require an initial (fixed) payment of \$1,000,000 each quarter that we require its production capacity (there may be quarters in which we don't need that extra capacity), independently of how many panels it will be producing. Each solar panel can be sold for \$2,500. The production cost is \$1,000 per solar panel if they are manufactured in our facilities, and \$1,200 if they are produced by the subcontractor. If the solar panels are kept in inventory, it costs \$100 per solar panel per quarter, independently if it was produced at our facilities or at the subcontractor's. There is the

third option of giving up the demand of panels that we cannot satisfy, but that would represent an opportunity cost of not selling the panels (at \$2,500 each panel not sold).

Please do the following:

- a) Present your work progress of *parts b)* and *c)* by the end of today's session (50 points).
- b) Utilize the curve-fitting method to create a regression model (trendline) to predict the following 4 quarters, based on the **deseasonalized data** that appears on the file *BUS2-194B_NLO-Case-Data.xlsx*.

→ *Hint: you can use the quarter number (1, 2, 3, 4, 5, ..., 46) as the independent variable (variable x) to predict the sales (variable y)*

- c) What would be the optimal production, inventory, and subcontracting plan (how many units per quarter) to satisfy the demand for the following 4 quarters (that you predicted in *part b)*)? How many customers are you willing to give up to the competitors? (50 points).

→ *Hint 2: This problem is interesting in the sense that you need to use the knowledge from Modules 2, 3, and 4 to solve it.*

Please fill and submit the following table by including the name of each team member and evaluating her or his participation and commitment as follows: 3 - high level of participation and commitment in the project; 2 - intermediate level of participation and commitment in the project; 1 - poor level or no participation and commitment in the project. The individual grades will be adjusted depending on the evaluation of your team. The table should be filled only once per submission, and it has to be done by team consensus.

Member name	Evaluation
Member A	1 or 2 or 3
Member B	1 or 2 or 3
⋮	⋮

Deadline

The solutions for this case should be submitted to the appropriate section in Canvas at <https://sjsu.instructure.com/>. **Please include all the team members names.** The deadline for the submission is:

→ **Tuesday, March 29, 11:59 PM**

→ Submit before **Sunday, March 27, 11:59 PM** for 5 extra points.

Rubrics

The solutions for this problem homework will be evaluated utilizing the following *rubrics*:

	Assessment		
Points	Modeling	Solution	Writing
100%	The model reflects correctly the problem under study, and it was developed utilizing the six-steps process	The solution is numerically correct, and the interpretation of the solution is appropriate to the problem	Writing is concrete and addresses the problem
85%	The model reflects correctly the problem under study. It was not developed utilizing the six-steps process	The numbers are not correct but the interpretation of the solution is appropriate to the problem	The problem is addressed but the writer repeats some phrases unnecessarily
50%	The model has some flaws. At least half of it reflects the problem under study	The numbers are correct but the interpretation of the solution is not provided	There are contradictions in the writing
0%	Less than half of the problem is represented in the model	The numbers are not correct and the interpretation of the solution is not provided	The problem is not addressed