Term Project **Operations Management**

Description

You will be required to submit a written report to management and to **include the spreadsheet** models you used to generate price forecasts, optimize the raw material, and perform the break-even analysis. All analysis should be done using **Excel** and the various models should be implemented on separate worksheets or in separate workbooks.

Scenario

TourneSol Canada, Ltd. is a producer of high-quality sunflower oil. The company buys raw sunflower seeds directly from large agricultural companies and refines the seeds into sunflower oil that it sells in the wholesale market. As a by-product, the company also produces sunflower mash (a paste made from the remains of crushed sunflower seeds) that it sells into the market as a base product for animal feed.

The company has a maximum input capacity of 150 short tons of raw sunflower seeds every day (or 54,750 short tons per year). Of course, the company cannot run at full capacity every day as it is required to shut down or reduce the capacity for maintenance periods every year, and it experiences the occasional mechanical problem. The facility is expected to run at 90% capacity over the year (or on average 150 x 90% = 135 short tons per day).

TourneSol is planning to purchase its supply of raw sunflower seeds from three primary growers, Supplier A, Supplier B, and Supplier C. Purchase prices will not be set until the orders are actually placed so TourneSol will have to forecast purchase prices for the raw material and sales prices for the refined sunflower oil and mash. The contract is written such that TourneSol is only required to commit to 70% of total capacity upfront. Any amounts over that can be purchased only as required for the same price. Historical prices for the last 15 years are in the table below (note that year 15 is the most current year).

Marketing Year	Seed Average Price Index $/short ton	Oil Average Price Index $/short ton	Mash Average Price Index $/short ton
1	127.7	317.8	63
2	192.4	465	87

3	242	662.2	105
4	242	668.2	111
5	274	791.3	124
6	242	732	108
7	290	951	134
8	347.2	1123	153
9	436	1297.3	193
10	422.8	1312	187
11	466	1416	193
12	582	1664	247
13	508	1317.4	242
14	428	1182.4	197
15	434	1334.4	210

Sunflower oil contains a number of fatty acids, some of which are desirable in food products and others that are not. One desirable fatty acid is oleic acid. TourneSol produces high oleic oil for the wholesale market and requires that the oleic acid content be a minimum of 77%. Sunflower oil also contains trace amounts of iodine. The market requires that iodine content be a minimum of 0.78% and a maximum of 0.88%

The oleic acid and iodine content for the sunflower seeds from the three suppliers is given in the table below.

A	72%	0.95%
B	82%	0.85%
C	65%	0.72%

For all three suppliers, it is expected that the average yield of oil from the seeds is 30%. There is no net loss of material, so the yield of mash from the same supply is expected to be 70%.

Because the oleic acid and iodine content varies across the three suppliers, so does the price. It is expected that the cost of supply from the suppliers will be a percentage of the market average price of seeds.

A	85%
B	100%
C	90%

The company faces an additional variable production cost of $10/short ton and an estimated fixed cost of $1,750,000 over the upcoming production period.

The company is asking you to provide a recommendation on the amount of raw material it should purchase from each supplier to minimize its cost of feedstock.

Management is also looking for an analysis of the profitability of the company in the next production cycle.

Suggested Approach

This is a fairly complex problem. The following approach is suggested:

1- Use the historical price data set as input to a time series **forecast model** in order to generate forecasted prices for the average price of sunflower seeds, oil, and mash in the next production period. Use standard measures of error to decide between a three-period moving average model or an exponential smoothing model (with α = 0.2). Use the type of model for all three-time series forecasts. That is if you decide to use the moving average model, use a three-period moving average model to fit the relevant data for all three series. Don't use the moving average for one time series and the exponential smoothing model for another time series.

2- Formulate **a linear program** to minimize the cost of raw sunflower seeds. Use the average price of seeds forecasted from the previous step in order to determine supplier prices.
3- Perform a cost-volume-price analysis (review the handout entitled **Cost-Volume-Profit Analysis** for details) using the average cost per short ton and average selling price per short ton.
    - You can generate an effective cost per short ton by dividing the total cost of supply (from the linear program) by the total volume (that you assumed in the linear program).
    - You can generate an effective selling price per short ton from the expected percentage yields and the forecasted average price of sunflower oil and mash.
    - Because of the way that the contract is written, you can assume that the purchase of raw sunflower seeds is a variable cost (you only purchase what you require).

Recall that the cost-volume-price analysis requires you to provide:

- an algebraic statement of the revenue function and the cost function,
- a detailed break-even chart that includes lines for the revenue and for the total cost, fixed cost, and variable cost (a total of four lines), and
- a calculation break-even point expressed in the number of short tons and percent of capacity.

Management Report

Prepare a written management report that includes, at a minimum, the following sections:

- Purpose of the Report
- Description of the Problem
- Methodology (which would include the model formulation)
- Findings or Results
- Recommendations or Conclusions

Be sure to address all relevant points, discuss any assumptions you are making, justify any modeling choices you have made (for example, the choice of time series forecast model), and highlight the following items in your report:

- a forecast of the next production period's average price index for raw sunflower seeds, sunflower oil, and sunflower mash,
- a recommendation for the optimal purchasing strategy from the various suppliers,
- a cost-volume-profit analysis used for the recommended purchase strategy and the forecasted sunflower oil and mash sales price,
- a discussion of the risks and uncertainties that are faced by the company, and
- analysis and opinion on the profitability of the company in the next production period (accounting for the expected profit or loss and the inherent risks/uncertainties.

Remember that you are writing the report from the point of view of a consultant with senior management of TourneSol Canada, Ltd. as the intended audience.

Must do:

- Make a research paper and discuss your understanding and critical thinking for the selected company. (No limit for the number of pages and words)
- Present your project as a group, record it using MS Teams, and include the link in your report.

Evaluation

Term Projectwill be marked in its entirety out of 100. The following rubric indicates the criteria students are to adhere to, and their relative weights to the assignment overall.

Content	**/80**
Presentation	/25
Extent to which the report supports conclusions and demonstrates an understanding of the principles being analyzed and critical thinking	/45
Extent to which the Introduction and Conclusion support the overall analysis.	/10
Communication	**/20**
Uses clear language and appropriate, topic-specific terminology.	/10
Information is organized intelligently and holistically.	/10
Total	**/100**