SCM6111: Supply Chain Modelling and Analytics

Project: Inventory Planning System

Amazing Coffee decides to operate a shop at Hong Kong and sells three of their most popular beverages – Cappuccino, Latte and Mocha, which are composed of the following ingredients:

- i) Cappuccino: Coffee Bean (40g), Milk Foam (10g), Steamed Milk (10g)
- ii) Latte: Coffee Bean (25g), Milk Foam (5g), Steamed Milk (20g)
- iii) Mocha: Coffee Bean (30g), Steamed Milk (20g), Chocolate Powder (15g)

Every Sunday Amazing Coffee needs to forecast the demands in the next week. To reduce risk of getting out-of-stock, the procurement should ensure that there is sufficient coffee bean, milk foam, steamed milk and chocolate powder in shop for the next week. The demands in previous 15 days are recorded in the Excel file "demand_history.xlsx".

Ingredients	Coffee Bean	Milk Foam	Steamed	Chocolate
			Milk	Powder
Ingredient Cost per kg	\$14	\$8	\$6	\$5
(Except Thursday)				
Ingredient Cost per kg	\$11.9	\$6.8	\$5.1	\$4.25
(Thursday)				
Inventory holiday cost per	\$2.6	\$0.6	\$1	\$0.3
kg per day				

Table 1. Costs of each ingredient

As shown in Table 1, there are different costs for each ingredient, in which coffee bean costs \$14 per kg, milk foam costs \$8 per kg, steamed milk costs \$6 per kg and chocolate powder costs \$5 per kg. Because of the promotion activity from the supplier, the company can order the materials using a discount price, i.e. 15% off, for each type of ingredient on every Thursday.

However, no order can be made on every Tuesday and Friday. As the company can order more than the daily demand and store the ingredient in shop for future use, the inventory holding cost for each ingredient is incurred. There is no inventory held before Monday.

Amazing Coffee is going to develop a system to prepare the ordering plan based on the forecasted demands in the next week (Day16 to 22).

What to do:

1. [Proposal] Being the representative of your company, you are required to first use datadriven forecasting methods to predict the demand in the next week. Report your forecasting model, e.g., what method you choose, what the results are, what assumptions or limitations are.

2. [Proposal] Then you need to prepare a material ordering plan to determine when to order and the amount to order for each ingredient for minimizing the overall cost (i.e. ingredient cost and holding cost). Formulate a linear programming model for this problem.

3. [**Proposal+ Prototype**] Create a user interface to allow the manager to change the daily demand for planning the new ordering schedule. You may also include the forecasting function, which is **optional**.

4. [**Prototype**] Add more functions to your system to evaluate the decision making for different scenarios of cost parameters.

5. [Proposal] Discuss your results and conduct sensitivity analysis to discuss any change to material ordering plan.

6. [Optional: Proposal + Prototype] Provide extended recommendations and demonstrations on how the company can further improve the functionalities of planning system by considering different possible scenarios such as changing demands, ordering policy, designing new products, etc.

Submission:

- You can work in **a group of max. of four people** for the submission of proposal (including points 1,2,3, 5) in the format of power point slides and the prototype of inventory planning system (including points 3 and 4).
- Extended recommendations and demonstration of additional functionalities (point 6) are optional and normally expected for the group aiming to show their understanding and teamwork. In other words, individual work is purely optional and not expected to be provided extended recommendation.
- The submission of proposal and prototype will be due on **30 April 2025**. The proposal is expected in the format of power point slides (pptx or ppt) and the prototype will be in the form of spreadsheet or python. All files would be compressed in a zip file for the submission. The zip file will be submitted to Moodle system.
- The details of proposal and prototype are as follows:
 - The proposal normally includes the overview of data-driven forecasting, inventory planning system and the descriptions of intelligent logic (point 1), user interface (point 3), key functions (point 4), result and sensitivity (point 5). The number of slides is expected in the range of 20-40 slides. For the submission with recommendations (point 6), 10-20 additional slides could be included as the appendix.
 - The prototype would be implemented via the programming languages of Python or VBA with solver. There is indifferent priority among the programming language, while the criteria would be focused on the usability (point 3), functionality (point 4) and robustness (point 6, optionally again) from a supply

chain manager's perspective. It is expected that the prototype would be implemented with the standard libraries used in the class. If additional libraries are required to run the prototype, source codes with guidelines are required for the submission.

• It is possible to seek the teacher's advice on proposal, but not the development of prototype including debugging, due to the fairness concern. If any inquiries are needed to clarify the proposal, please feel free to raise your questions via email.