Exercise 1: Operations Excellence

You operate two plants, i.e., A and B. Each plant makes two products, "standard" and "deluxe". A unit of standard gives a profit contribution of $10, while a unit of deluxe gives a profit contribution of $15.

Each plant uses two processes, grinding and polishing, for producing its products. Plant A has a grinding capacity of 80 hours per week and polishing capacity of 60 hours per week. For plant B, these capacities are 60 and 75 hours per week, respectively.

The grinding and polishing times in hours for a unit of each type of product in each factory are given in the tables below.

For Plant A

	Standard	Deluxe
Grinding	4	2
Polishing	2	5

For Plant B

	Standard	Deluxe
Grinding	5	3
Polishing	5	6

It is possible, for example, that plant B has older machines than plant A, resulting in higher unit processing times. In addition, each unit of each product uses 4 kg of a raw material, which we refer to as raw. The company has 120 kg of raw available per week. To start with, we will assume that plant A is allocated 75 kg of raw per week and plant B the remaining 45 kg per week. Each plant can build a very simple linear programming model to maximize its profit contribution.

1. Write the optimization models for each plant, i.e., make sure to detail the decision variables, the objective function and the constraints.
2. Provide the optimal solutions and profit levels for each factory. Give the values of the decision variables and the optimal objective function value.
3. Now, write the optimization model for the joint optimization of Plant A and B, and provide the optimal solution and profit levels.
4. Please comment on the results? How do they compare to the results obtained in Question 2.
5. In one paragraph (no more than 300 words), detail the recommendations you would provide to the CEO of the company to improve the firm's operations?