Final Project

Operations Research 2024-2025

Smartphone Factory

A tech company produces three models of smartphones: basic, standard, and premium. The number of components and labour hours required for manufacturing these three models are summarized in the following table:

Resources and components	Model		
	Basic	Standard	Premium
Processors	1	1	2
Screens	1	1	1
Batteries	1	2	3
Labour hours	3	5	8

The company has a weekly availability of 500 processors, 400 screens, 600 batteries, and 1200 labour hours.

The profit per unit sold varies among the models: €50 for the basic model, €80 for the standard model, and €120 for the premium model. To ensure market presence, the company must produce at least 50 units of each model weekly. Additionally, the number of premium phones cannot exceed 40% of the total phones produced.

The company has engaged your team to determine the number of phones of each model to produce in order to maximize weekly profit.

1. Formulate the mathematical model.
2. Write the model in compact form and matrix forms.
3. Indicate the number of constraints and real variables in the problem.
4. Write the LINGO code using the @sum and @for commands.
5. Determine the maximum profit the company can achieve and the number of devices of each model required to achieve it.
6. The company is considering a collaboration with a supplier who offers the option to increase the weekly availability of one resource. The company can only choose one option and requests your team to select the one that maximizes net profit:

- Processors: Increase by 10 units at a cost of €80.
- Labour Hours: Increase by 20 hours at a cost of €120.

7. If the selling price of the standard model increases to €90, would the optimal solution change? What if the selling price of the premium model increases to €130? In both cases, specify the resulting profit.

8. If the availability of processors is reduced to 450 units, how would this affect the solution? Would it still be possible to produce the same quantities of each model? Indicate how the solution vector for all variables would change.

9. The company's partners are considering easing the restriction that limits premium phones to no more than 40% of total production, arguing that this regulation is negatively impacting profits. Do you agree with their perspective?

10. To define the new commercial strategy, the partners want to explore what the profit would be if the restriction of being present in all markets with at least 50 units were removed:

    a) Formulate the new problem.

    b) Express it in standard form.

    c) What is the optimal combination of phone models to produce?

    d) What would be the weekly profit obtained?

    e) What type of solution is it?

11. Determine the minimum price at which premium phones should be sold to make their production viable under this new context. What type of solution would the problem have if the model reached this price?