c Verification

In this part, the implemented mathematical model is tested through three types of verification experiments: objective function parameters, functional parameters, and RHS parameters.

Objective function parameters: Objective function parameters verification tests involve adjusting the holding costs of inventory and procurement costs to observe their impact on the overall minimized cost and storage levels, aiming to find out whether the objective function behaves as expected. In this report, storage cost of 18/0 product is increased to see whether overall cost is increased and storage level of 18/0 product is decreased. Also, procurement cost of supplier B is decreased to find out whether overall cost is decreased and procurement from supplier B is increased.

Functional parameters: Functional parameters verification tests modify the demand and supply configurations, such as limiting suppliers or demands, to verify the model's ability to handle functional constraints and their impact on the optimization results. In this report, tests are conducted to see whether the model can handle the "unmix" problem and produce "pure" metal.

RHS parameters: RHS parameters verification tests modify production capacity or supply limits, to check whether changes in minimized cost and production schedule due to fluctuation in capacity and supply behave as expected. Additionally, the given example verification is conducted in this part.

Table 7: Verification

Parameter	Description	Expected	Result	Pass?
Objective function parameter	Increase the storage cost of 18/0 product from 5 to 20	minimized cost > 9646.78 euro; storage decrease of 18/0 product	minimized cost = 17148.28 euro; storage decrease of 18/0 product in every month	OK
	Decrease the procurement cost of supplier B from 10 to 1	minimized cost < 9646.78 euro; increased procurement from supplier B	minimized cost = 8489.83 euro; increased procurement from supplier B for product 18/10 and 18/8	OK
Functional parameter	Adjust demand to produce only 1kg 25/0 product in the first	No optimal result	No optimal result	OK
	Adjust supply to have only two suppliers supplying pure metal	No optimal result	No optimal result	OK
RHS parameter	Increase the maximum production capacity from 100 to 1000	minimized cost > 9646.78 euro; decreased storage	minimized cost = 8005.89 euro; storage decrease of all products	OK
	Increase the maximum supply from supplier A from 90 to 900	minimized cost < 9646.78 euro	minimized cost = 9515.35 euro	OK
	Verification with a demand of Jan [10,10,10] and Feb-Dec zero	minimized cost = 185.58 euro	minimized cost = 185.58 euro	OK

Table 7 provides a comprehensive overview of the verification process. A total of seven verification tests were conducted to assess whether the mathematical model was implemented correctly. The table presents the test description, expected result, actual result, and the pass/fail outcome. As shown, the model successfully passed all seven tests, demonstrating that the code matches the theoretical model. This successful verification confirms the reliability of the implementation and supports its validity for further analysis.