

SOT Challenge

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Problem

RentalBike is a bike sharing company specialized in short-term bicycle rentals along various areas of a city, offering different categories of bicycles. Clients may rent bicycles for any duration and may deliver the rented bicycles in a place different from where the rental started. However, the delivery place must be in one of the areas currently operated by RentalBike. Since clients are able to change the bicycles' original position, RentalBike must often redistribute the surplus of bicycles according to the expected demand of each area.

The decision of how many bicycles will be redistributed from one area to another is based on expected profits for each possible volume of bicycles to be moved. Therefore, before starting the relocation of bicycles, it is necessary to optimize the volume of bicycles to be moved from one area to the others.



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Strategy Allocation



Incremental Profit Values by Area



Areas 2, 5, and 7 exhibit an atypical distribution, where incremental profit values are concentrated at a single very high level. This suggests that few categories were reallocated in these regions or that their incremental profit was highly concentrated.

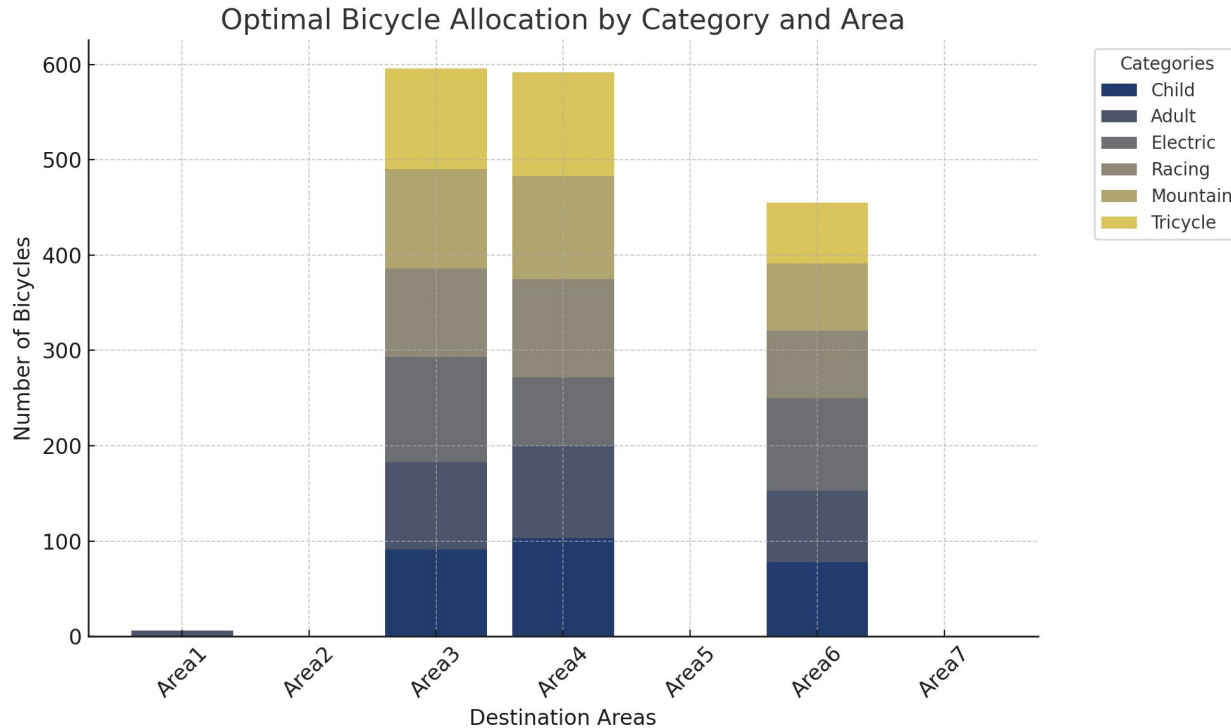
Areas 1, 3, 4, and 6 have more dispersed distributions, indicating greater variability in the incremental profits of the different categories.

Areas 3, 4, and 6 seem to have a more balanced distribution of incremental profit, suggesting that these regions benefited more from bicycle reallocation.

Focusing on areas 3, 4, and 6 would maximize profits, as these areas exhibit more consistent distributions of incremental profit values. Areas 2 and 5, on the other hand, show highly concentrated values, indicating low diversity or an atypical profit pattern. It may be worth investigating whether these areas are truly viable for reallocation.



Ideal Allocation



- Optimized total profit: \$78,866.16
- Truck capacity efficiently utilized
- Distribution by category and region maximizing demand

Key highlights:

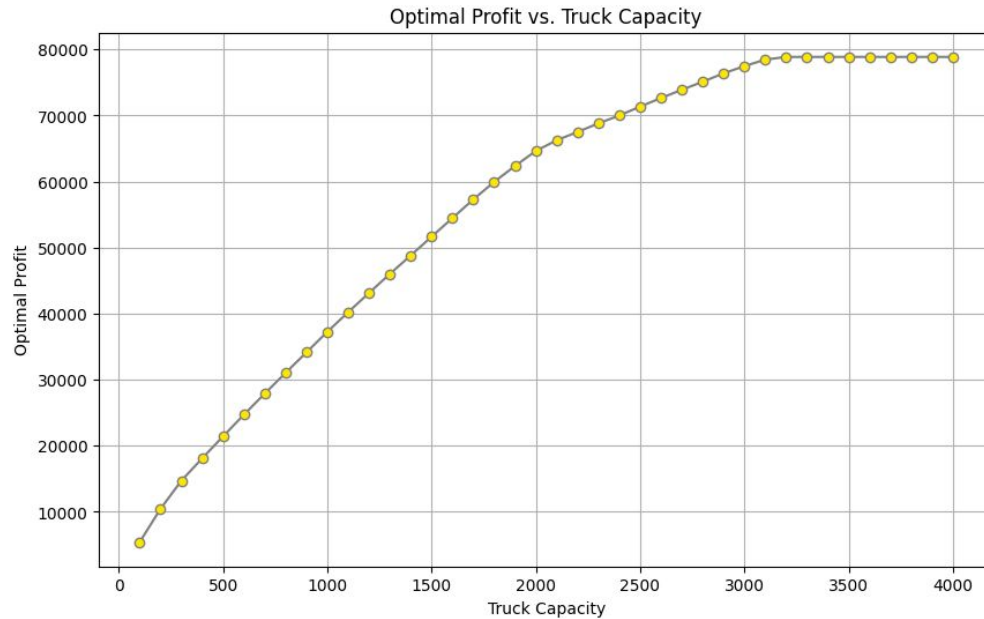
- Regions 3, 4, and 6 received the highest allocation
- No bicycles were allocated to Areas 2, 5, and 7

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Sensibility Analysis



Saturation Point



In the initial increases in transportation capacity, we observe a rapid growth in profits. This demonstrates that when bicycle transportation is limited, increasing capacity leads to significant gains.

From a capacity of approximately 3,000 units onward, profit reaches a stable plateau (Saturation Point), suggesting that there are no significant benefits in further increasing capacity beyond this point.



Optimal Allocation

Category	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7
Child	0.0	0.0	91	103	0.0	78	0.0
Adult	6.0	0.0	92	97	0.0	75	0.0
Electric	0.0	0.0	110	72	0.0	97	0.0
Racing	0.0	0.0	93	103	0.0	71	0.0
Mountain	0.0	0.0	104	108	0.0	70	0.0
Tricycle	0.0	0.0	106	109	0.0	64	0.0
Total	0	0	596	592	0	455	0

The study allows for defining an optimal truck capacity, balancing operational costs and financial returns. This prevents unnecessary investments in larger vehicles that do not add value to the operation.

Areas 3, 4, and 6 received the highest number of bicycles, confirming that these regions have higher demand and financial returns. In contrast, areas 1, 2, 5, and 7 received little to no allocations, suggesting low economic feasibility for reallocation in these locations.

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Final Insights



Final Remarks

- Optimized total profit considering a truck with an 80 kg capacity: \$4,358.78.
- Optimized total profit without considering truck capacity: \$78,866.16.
- The saturation point is identified at 3,100 kg.
- Regions 3, 4, and 6 received the highest allocation confirming that these regions have higher demand and financial returns.
- Analysis of variation by category, as some categories appear more advantageous depending on the area.
- Incorporation of demand forecasting using a forecast model.
- Feasibility study for a dynamic pricing system (similar to Uber).
- Incentives for users who return bicycles to specific locations (areas with lower bicycle availability).

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Thank you

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