**CREATIVE PROBLEM SOLVING**

**PRACTICAL TASK**

**Optimizing delivery routes with AI**

**Objective of the task:** to use AI to optimize delivery routes for a local delivery service, reducing fuel costs, delivery time, and environmental impact.

**Situation**:

You are tasked with improving the efficiency of a delivery company that handles hundreds of deliveries each day. Currently, the company uses manually planned routes, which often result in delays, higher fuel consumption, and increased costs.

You have these data:

**Dataset description**

***1. Delivery addresses (locations):***

A list of delivery addresses with coordinates (latitude, longitude) for optimization.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Delivery ID | Address | Latitude | Longitude | Time window | Packages |
| 1 | 123 Main St. | 40.7128 | -74.0060 | 9:00-11:00 | 3 |
| 2 | 456 Elm St. | 40.7306 | -73.9352 | 12:00-14:00 | 5 |
| 3 | 789 Oak St. | 40.6971 | -73.9795 | 10:00-12:00 | 2 |
| 4 | 321 Maple Ave. | 40.7527 | -73.9772 | 13:00-15:00 | 4 |
| 5 | 654 Pine Blvd. | 40.7580 | -73.9855 | 15:00-17:00 | 1 |

***2. Vehicle types and capacities:***

The vehicle data includes the type, capacity in volume/weight, and fuel consumption per kilometer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Vehicle ID | Vehicle type | Capacity (kg) | Capacity (m³) | Fuel consumption (L/km) |
| V1 | Van | 1000 | 15 | 0.12 |
| V2 | Truck | 5000 | 35 | 0.25 |
| V3 | Bike | 100 | 0.5 | 0.03 |
| V4 | Electric Van | 800 | 12 | 0.06 (electric) |
| V5 | Small Van | 600 | 8 | 0.10 |

***3. Average delivery time per stop:***

Data for how long each delivery typically takes, factoring in traffic and unloading.

|  |  |
| --- | --- |
| Delivery ID | Average delivery time (mins) |
| 1 | 15 |
| 2 | 20 |
| 3 | 10 |
| 4 | 25 |
| 5 | 30 |

***4. Traffic data (peak hours, delays):***

Traffic patterns are modeled with estimated delays during different hours.

|  |  |
| --- | --- |
| Time slot | Traffic delay (mins/km) |
| 8:00-10:00 | 5 |
| 10:00-12:00 | 3 |
| 12:00-14:00 | 7 |
| 14:00-16:00 | 4 |
| 16:00-18:00 | 10 |

***5. Fuel consumption for each vehicle:***

Fuel consumption per delivery route based on the total distance traveled (in kilometers).

|  |  |  |
| --- | --- | --- |
| Vehicle ID | Distance traveled (km) | Fuel consumption (L) |
| V1 | 50 | 6 |
| V2 | 70 | 17.5 |
| V3 | 10 | 0.3 |
| V4 | 40 | 2.4 (electric) |
| V5 | 30 | 3 |

**Problem parameters**

***1. Number of packages to deliver in one day:***

Each day, there are 100 packages distributed across various delivery addresses.

***2. Maximum vehicle capacity:***

The capacity of each vehicle is limited by weight and volume. Each package has an average weight of 10 kg and takes up 0.2 m³.

***3. Time windows for deliveries:***

Some customers have specified time windows within which deliveries must be made, which adds complexity to route planning.

***4. Traffic patterns:***

* Peak traffic hours: 8:00-10:00, 12:00-14:00, and 16:00-18:00.
* Traffic delays vary throughout the day, impacting delivery times and fuel efficiency.

**Task**:

* Use AI to plan the most efficient delivery routes for drivers, considering vehicle capacity, delivery time windows, traffic patterns, and fuel consumption.
* Try different AI tools, like ChatGPT, Google Gemini or Microsoft Copilot and compare their problem-solving suggestions.