Optimizer's Inc.

Addressing the CrowdMark City Crisis

Status Report 2

To: CrowdMark City Government

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STATUS REPORT 2

To: CrowdMark City Government
From: Optimizer's Inc.
Date: April 12th, 2025
Subject: Near Finishing

After relentless efforts, our team at Optimizer's Inc. is happy to announce that it has extended the maximization of resource outreach with supply station placement to beyond just one supply station, weeks ahead of schedule! We hope this will be beneficial to CrowdMark City in addressing the crisis.

Problem Formulation

We easily extended the previous formulation for one supply station to multiple by introducing more coordinates

$$\min \sum_{k=1}^{n} \sum_{i=1}^{24} p_i(|x_k - u_i| + |y_k - v_i|)$$

Where u^i, v^i are locations for each supply station, for a total of n of them.
For the constraints, we extended the previous constraints (5 per neighborhood) to also have 5 per supply station.

$$\begin{aligned} s.t.\ x_i - u_k &\leq \delta_{x_i} \\ -x_i + u_k &\leq \delta_{x_i} \\ y_i - v_k &\leq \delta_{y_i} \\ -y_i - v_k &\leq \delta_{y_i} \\ \delta_{x_i} + \delta_{y_i} &\geq 1 \\ \forall\, i \in 1, 2, \ldots, 24 \;\forall\, k &\in 1, \ldots, n \\ x, y, u, v \in \mathbb{Z},\ x, y, u, v &\geq 0 \end{aligned}$$

Problem Implementation & Solution

Our team extended the previous Python code to run and solve our problem formulated above. We first added more variables in the beginning of the objective, two for each new supply station. We nested our original *for loop* for filling the constraints matrix in another, so it also iterates through every station. More details about the Python code will be in the Final Report.

Results

Our team deduced that the best place to place two supply stations are at the coordinates (13,10) and (10,7). This maximizes outreach to the highest population neighborhoods and minimizes distance to these neighborhoods, giving an objective result of around 4730.