Agriplots Linear Programming Model

Decision Variables

- X_j: Binary variable, equals 1 if a PV is installed at location j, 0 otherwise.

Objective Function

$$\text{Maximize} \quad \sum_{j=1}^{\text{num\_locations}} \left(\text{fix\_energy\_production}_j \cdot X_j\right)$$

Constraints

1. $$\sum_{i \in S[j]} X_i \cdot \text{fix\_energy\_production}_i \leq \text{energy\_consumption\_by\_yeshuv}_j \quad \forall j \in \{1, \dots, \text{num\_cities}\}$$
2. $$\sum_{i \in E[j]} X_i \cdot \text{fix\_energy\_production}_i \leq \text{energy\_division\_between\_eshkolot}_j \cdot \sum_{k=1}^{\text{num\_locations}} \left(\text{fix\_energy\_production}_k \cdot X_k\right) \; \forall j \in \{1, \dots, \text{num\_eshkolot}\}$$
3. $$\sum_{j=1}^{\text{num\_locations}} \left(X_j \cdot \text{area\_in\_dunam}_j\right) \leq \text{total\_area\_upper\_bound}$$
4. $$\sum_{j=1}^{\text{num\_locations}} \left(X_j \cdot \text{influence\_on\_crops}_j\right) \geq \text{influence\_on\_crops\_lower\_limit}$$
5. $$\sum_{j=1}^{\text{num\_locations}} \left(X_j \cdot \text{total\_revenue}_j\right) \geq \text{minimal\_total\_revenue}$$
6. $X_j \in \{0,1\} \quad \forall j \in \{1, \dots, \text{num\_locations}\}$

Explanations

- The **objective function** maximizes the total energy production from the installed PV systems at various locations.
- **Constraint (1)** ensures that the total energy production for each city does not exceed its energy consumption limit.
- **Constraint (2)** limits the energy produced within each eshkol (group) to a certain percentage of the overall energy production.
- **Constraint (3)** places an upper bound on the total area used for PV installations.

- **Constraint (4)** ensures that the total influence on crops from installed PV systems remains above a certain threshold.
- **Constraint (5)** guarantees that the total revenue from the PV systems meets or exceeds the required minimum revenue.
- **Constraint (6)** requires that each decision variable X_j is binary, meaning that a PV system is either installed or not at each location.