MarketUp Formulation

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The statement of the use case is on Mip Wise's website: mipwise.com/use-cases/marketup.

Input Data Model

Set of indices

- I set of marketing channels.

Specifically, $I = \{1, 2, 3, 4\}$, where $1, 2, 3, 4$ correspond to Print, TV, SEO, and Social Media, respectively.

Parameters

- r_i expected ROI (percentage of invested capital) from channel i.
- p_i expected market penetration (number of viewers per dollar invested) with channel i.
- tb total budget.
- pb print budget.
- vt number of viewers target.
- ca conventional channels allocation, i.e., minimum percentage of total budget allocated to Print and TV.

Decision Variables

Since we want to maximize ROI across all the marketing channels, our decision variable is the budget allocated to each of the four marketing channels:

- x_i budget to be allocated to channel i.

Constraints

- C1) *Can't exceed the total budget*:

$$x_1 + x_2 + x_3 + x_4 \leq tb.$$

- C2) *Minimum allocation to conventional channels*:

$$x_1 + x_2 \geq ca \cdot tb.$$

- C3) *Can't exceed the print budget*:

$$x_1 \leq pb.$$

- C4) *Social Media investment must be at most three times SEO investment*:

$$x_4 \leq 3 \cdot x_3.$$

- C5) *Reach minimum viewers target*:

$$p_1 x_1 + p_2 x_2 + p_3 x_3 + p_4 x_4 \geq vt.$$

Objective

The goal is to maximize total ROI across all the marketing channels:

$$\max r_1 x_1 + r_2 x_2 + r_3 x_3 + r_4 x_4.$$

Final Formulation

Putting everything together, we obtain the following linear program.

$$\begin{aligned}
\max \quad & \sum_i r_i x_i && (1)\\
\text{s.t.} \quad & \sum_i x_i \le tb && (2)\\
& x_1 + x_2 \ge ca \cdot tb && (3)\\
& x_1 \le pb && (4)\\
& x_4 \le 3 \cdot x_3 && (5)\\
& \sum_i p_i x_i \ge vt && (6)\\
& x_i \ge 0, \quad \forall i. && (7)
\end{aligned}$$