Marketing Budget Optimization

Francisco Solis

Outline:

1. Define optimization problem
2. Background information for the problem
3. Analysis of results

Discussion:

1. An optimization problem has the goal to maximize or minimize the value of an objective function. The constraints are logical expressions defined by using equalities and/or inequalities. A solution to the optimization problem is one where the set of finite constraints are all satisfied.

2. The background information of the problem to be solved is as follows:

    a. There are 5 advertisement companies being Redbull (1), Coca Cola (2), Pepsi (3), Monster (4) and YerbaMate (5). For simplicity these will be labelled numerically to be used in MATLAB.

    b. When displaying each advertisement, the profit from each is shown in the table below:

1	RedBull	$400
2	Coca Cola	$600
3	Pepsi	$700
4	Monster	$600
5	YerbaMate	$900

    c. The constraint is that the advertisements cannot be displayed at the same time due to the competitive market of these drink brands. Specifically, the brands have requested that these pairs of advertisements are prohibited.

    (1,2): Redbull and Coca Cola
    (1,5): Redbull and YerbaMate
    (3,5): Pepsi and YerbaMate
    (2,4): Coca Cola and Monster
    (3,4): Pepsi and Monster

    d. The binary variables are x_i from 1-5 where $x_i=1$ means the advertisements is displayed and $x_i=0$ means the advertisements is not displayed.

3. The optimization problem was formulated to maximize total advertising profit subject to conflict constraints between competing brands. Five advertisements were considered, each with an associated profit value ranging from $400 to $900.Conflict constraints were included to ensure that competing brands would not be displayed simultaneously. For example, RedBull and Coca Cola (ads 1 and 2) could not both be selected, and similar restrictions were applied for the pairs (1,5), (3,5), (2,4), and (3,4). This formulation resulted in an integer linear programming problem, solved in MATLAB using the Optimization Toolbox. The optimal solution identified **advertisements 2 (Coca Cola) and 5 (YerbaMate)** as the profit-maximizing combination. Together, these ads yield a maximum profit of **$1,500**, while satisfying all conflict constraints. This result is logical because both advertisements are among the highest profit contributors individually ($600 and $900), and unlike other high-profit ads (such as Pepsi at $700), they do not conflict with each other. Thus, the solution balances both the profitability of selections and the feasibility imposed by competitive restrictions.