MIP 2 Food Beverage Production

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1 Introduction

I: Set of of products, 1, 2, 3, 4, 5, where 1 and 2 are foods and 3, 4 and 5 are beverages
T: Set of time periods

$X_{i,t}$: amount of product i produced at time t
$S_{i,t}$: amount of product i stored at time t
$Y_{i,t}$ 1 if product i is produced at time t, 0 otherwise

$r_{i,t}$: revenue per unit of product i at time t
$cf_{i,t}$: fixed cost of producing product i at time t
$cv_{i,t}$: variable cost of producing product i at time t
$cs_{i,t}$ variable cost of storing i at time t
$d_{i,t}$: the maximum demand of product i at time t. Note that the
p_i: the production capacity of product i
s_i: the storage capacity of product i

Please note that
1. $S_{i,t-1} + X_{i,t} - Si, t$ is equal to the products sold
2. demand does not need to be fulfilled but serves as an upper bound for the number of units sold.
3. $S_{i,t-1} + X_{i,t} - Si, t$ should be replaced with $X_{i,t} - Si, t$ when solving the problem because $S_{i,-1}$ is the initial storage of product i which equals 0

Maximize $\sum_{i \in I} \sum_{t \in T} r_{i,t} * (S_{i,t-1} + X_{i,t} - Si,t) - cv_{i,t}X_{i,t} - cf_{i,t}Y_{i,t} + cs_{i,t}S_{i,t}$

Subject to:

$$S_{i,t-1} + X_{i,t} - Si,t \leq d_{i,t}, \qquad \forall i \in I, t \in T$$

$$X_{i,t} \leq p_i Y_{i,t}, \qquad \forall i \in I, t \in T$$

$$S_{i,t} \leq s_i, \qquad \forall i \in I, t \in T$$

$$X_{i,t} \in Z^+, \qquad \forall i \in \{1,2\}, t \in T$$

$$X_{i,t} \in R^+, \quad \forall i \in \{3,4,5\}, t \in T$$

$$Y_{i,t} \in \{0,1\}, \qquad \forall i \in I, t \in T$$

$$S_{i,t} \in Z^+, \qquad \forall i \in \{1,2\}, t \in T$$

$$S_{i,t} \in R^+, \quad \forall i \in \{3,4,5\}, t \in T$$