

MIP 2 Food Beverage Production

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1 Introduction

I : Set 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 $X_{i,t} - Si, t$ for $t = 0$ when solving the problem because $S_{i,-1}$ is the initial storage of product i which equals 0

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

$$\begin{aligned} \text{Subject to:} \quad & S_{i,t-1} + X_{i,t} - S_{i,t} \leq d_{i,t}, & \forall i \in I, t \in T \\ & X_{i,t} \leq p_i Y_{i,t}, & \forall i \in I, t \in T \\ & S_{i,t} \leq s_i, & \forall i \in I, t \in T \\ & X_{i,t} \in Z^+, & \forall i \in \{1, 2\}, t \in T \\ & X_{i,t} \in R^+, & \forall i \in \{3, 4, 5\}, t \in T \\ & Y_{i,t} \in \{0, 1\}, & \forall i \in I, t \in T \\ & S_{i,t} \in Z^+, & \forall i \in \{1, 2\}, t \in T \\ & S_{i,t} \in R^+, & \forall i \in \{3, 4, 5\}, t \in T \end{aligned}$$