

COMP3821 Homework 4

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Question 2.

2.1 Variables.

n is the number of distinct toys t_i that can be produced.

m is the number of factories f_j available for producing toys.

C_i is the setup cost for a new factory i .

P_i is the profit for selling each toy i .

H_j is the total production hours for factory j , h_j is the hours used.

A_{ij} is the production rate (toys/hour) of toy i at factory j .

S is the map of factories to tuples containing the number of toys e.g. (toy 1: 4, toy 2: 5).

2.2 Constraints.

$(\sum_{i=1}^n P_i) - C_j > 0$ to make a net profit at factory j .

$h_j \leq H_j$ for all $0 \leq j \leq m$.

2.3 Objective.

Maximize the net profits per factory to get the maximum total profit from selling toys. Hence the goal is to maximize,

$$\sum_{s_j \in S}^m profit(s_j)$$

where $profit(s)$ sums up the total net profit of toys made at a factory.

2.4 Polynomial-Time Solution.

Since this is an integer LP problem, it is fundamentally NP-hard with no deterministic polynomial-time solution. However, a polynomial solution may exist for specific instances of the integer LP problem. This could be one, although, it is not known.