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 availiable 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.