

# COMP3821 Homework 4

Jiasheng Qin, z5258237

April 2020

## 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. However, a polynomial solution may exist