

# 1.

(i.)

- Set
  - $I$  : the set of food, i.e.,  $I = \{\text{Bread, Peanut butter, Strawberry jelly, Graham cracker, Milk, Juice}\}$
  - $J$  : the set of food nutrition, i.e.,  $J = \{\text{Calories from Fat, Total Calories, Vitamin C, Protein}\}$
- Index
  - $i$ : the index of the set  $I$ , i.e.,  $i \in I$
  - $j$ : the index of the set  $J$ , i.e.,  $j \in J$
- Parameters
  - $a_{ij}$  : amount of nutrition  $j$  from food  $i$
  - $b_j$  : amount of food nutrition  $j$  constraint per meal
  - $c_i$  : cost of food  $i$  per unit chosen.
- Decision variables
  - $x_i$  : the number of food  $i$  to choose for each child.

(ii.)

object function:

$$\text{Minimize } Z = 5x_1 + 4x_2 + 7x_3 + 8x_4 + 15x_5 + 35x_6$$

subject to:

$$400 \leq 70x_1 + 100x_2 + 50x_3 + 60x_4 + 150x_5 + 100x_6 \leq 600$$

$$10x_1 + 75x_2 + 20x_4 + 70x_5 \leq 0.3(70x_1 + 100x_2 + 50x_3 + 60x_4 + 150x_5 + 100x_6)$$

$$3x_3 + 2x_5 + 120x_6 \geq 60$$

$$3x_1 + 4x_2 + x_4 + 8x_5 + x_6 \geq 12$$

$$x_1 = 2$$

$$x_2 \geq 2x_3$$

$$x_5 + x_6 \geq 1$$

$$x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$$

(iii)

Implementation on hw1.py

The optimal solution is  $\{2, 1, 1, 0, 1, 0\}$

Object function value : 57

# 2.

(i.)

下一狀態的機率分佈只能由當前狀態決定。

A stochastic process  $\{X_t\}$  is said to have the Markovian property if  $P\{X_{t+1} = j | X_0 = k_0, X_1 = k_1, \dots, X_{t-1} = k_{t-1}, X_t = i\} = P\{X_{t+1} = j | X_t = i\}$ , for  $t = 0, 1, \dots$  and every sequence  $i, j, k_0, k_1, \dots, k_{t-1}$  (from ORA\_02\_LPMC\_2020.pdf)

(ii.)

n=2, 0.04

n=5, 0.0371

n=10, 0.0385

n=20, 0.0384

(iii.)

取到小數以下第四位

[0.6153 0.1923 0.0384 0.1538

0.6153 0.1923 0.0384 0.1538

0.6153 0.1923 0.0384 0.1538

0.6153 0.1923 0.0384 0.1538]

(iv.)

Expected average cost per period: \$1152