HW05: Problem Solving

Assume you open your ice cream shop, there are only two types of ice cream, vanilla and strawberry. When a box of ice cream is sold, you will get the benefit for $2 for vanilla ice cream and $3 for strawberry ice cream. To make the ice cream, the fresh milk is required. To make a box of vanilla ice cream requires 0.5 liter and strawberry ice cream requires 0.2 liter. You daily order 10 liters of fresh milk. To promote your ice cream shop, you give a doll for each ice cream box. The number of dolls, that you can give to customers, is 30 dolls per day.

Quiz Solving Approach

Mathematic Optimization Model

Decision Variables => Solution

X_i : the number of case type i { 1 : vanilla , 2 : strawberry }

{ X_1 : vanilla , X_2 : strawberry } <Box>

Objective

MAX: $2X_1 + 3X_2$

Constrains

<fresh milk>: $0.5X_1 + 0.2X_2 \leq 10$

<doll>: $1X_1 + 1X_2 \leq 30$

$X_1 , X_2 \geq 0$

MAX: $C_1X_1 + C_2X_2$

<fresh milk>: $a_{11}X_1 + a_{12}X_2 \leq b_1$

<doll>: $a_{21}X_1 + a_{22}X_2 \leq b_2$

$X_i \geq 0 \; \forall_i$

$X = [X_1 \quad X_2]$

$C = [C_1 \quad C_2]$, $C = [2 \quad 3]$

$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$, $A = \begin{bmatrix} 0.5 & 0.2 \\ 1 & 1 \end{bmatrix}$

$B = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$, $B = \begin{bmatrix} 10 \\ 30 \end{bmatrix}$

CX

$AX \leq B$

Use Python to find the answer

```
import numpy as np
from scipy.linalg import solve
C = np.array([2, 3])
A = np.array([[0.5, 0.2], [1, 1]])
B = np.array([10, 30])
X = solve(A, B)
print(X)
# [13.33333333 16.66666667]
MAX = 2*(13) + 3*(17)
print(MAX)
# 77
```

Conclusion : (how many boxes of vanilla ice cream and strawberry ice cream that you would like to produce to get maximum profit ?)

Vanilla ice cream 13 boxes and strawberry ice cream 17 boxes that you get maximum profit $77