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Homework 5: Problem Solving

Mathematic: Optimization Model

Decision Variable

X_1 : The number of vanilla ice cream (boxes)

X_2: The number of strawberry ice cream (boxes)

Objective:

Max profit: C = $2X_1 + 3X_2$

Constraints

1. Fresh milk: $0.5X_1 + 0.2X_2 \leq 10$ (1)
2. Doll: $X_1 + X_2 \leq 30$ (2)
3. $X_1 , X_2 \geq 0$

So, I converse all problem solving process to matrix array in python

Let A and b are constraints
obj is objective function
X is the number of each ice cream (boxes)

A = $\begin{bmatrix} 0.5 & 0.2 \\ 1. & 1. \end{bmatrix}$

b = $\begin{bmatrix} 10. \\ 30. \end{bmatrix}$

obj = $[2. \quad 3.]$

X = $[X_1 \quad X_2]$

Objective: obj*X

Constraints: AX = b

Result

To find maximize optimization, I ues **"from scipy.optimize import linprog"** but linprog() solves only minimization (not maximization) problems. So, I modify problem before starting optimization:

Objective will be: C = -2X_1 - 3X_2 and obj = $[-2. \quad -3.]$

Finally, I solve the problem of interest and the result as follows:

```
     con: array([], dtype=float64)
     fun: -90.0
 message: 'Optimization terminated
successfully.'
     nit: 1
   slack: array([4., 0.])
  status: 0
 success: True
       x: array([ 0., 30.])
```

The attributes of interest are

fun: is the objective function value at the optimum. (minimum: -90.0)

x: is a NumPy array holding the optimal values of the decision variables. (X_1=0., X_2=30.)

As a result, I will produce only strawberry ice cream (X_2) in 30 boxes to get a maximum profit of $90.