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HW05: Problem Solving

1. Define objective function and constraints in equation form.

Decision variable: X_1 = Strawberry ice cream

X_2 = Vanilla ice cream

Objective function: $MAX = 3X_1 + 2X_2$

Constraints: $0.2X_1 + 0.5X_2 \leq 10$

$X_1 + X_2 \leq 30$

$X_1 , X_2 \geq 0$

2. Find the values X_1 and X_2 from each constraint using $AX \leq B$. Initially assign values A (example: [0.2,0.5]) and B (example: [10,30]) by creating lists A and B and assigning all values from that uses a for loop to calculate all X_1 and X_2 values.

```
import numpy as np
from scipy.linalg import solve
A = [[[0.2,0.5],[1,1]],[[0.2,0.5],[1,0]],
     [[0.2,0.5],[0,1]],[[1,0],[1,1]],[[0,1],[1,1]]]
b = [[10,30],[10,0],[10,0],[0,30],[0,30]]
maxx = []
for i in range (5):
    x = solve(A[i],b[i])
    x = x.astype(int)
```

3. Create an empty list (maxx = [ ]) to store all the MAX values from the X_1 and X_2 representation in the objective function. Set the constraints condition before the X_1 and X_2 in objective function representation, then bring all the values to the maximum.

```
import numpy as np
from scipy.linalg import solve
A = [[[0.2,0.5],[1,1]],[[0.2,0.5],[1,0]],
     [[0.2,0.5],[0,1]],[[1,0],[1,1]],[[0,1],[1,1]]]
b = [[10,30],[10,0],[10,0],[0,30],[0,30]]
maxx = []
for i in range (5):
    x = solve(A[i],b[i])
    x = x.astype(int)
    constraints = (
        x[0]+x[1] <= 30,
        x[0] >= 0,
        x[1] >= 0,
        0.2*x[0]+0.5*x[1] <=10)
    if all(constraints) :
        C = np.array([3,2])
        Z = np.dot(C,x)
        maxx.append(Z)

maximum = max(maxx)
```

Output:

```
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

Maximum profit per day of your ice cream is 90 $
```