Case Study 3

**Question:**

Plastic Cup Factory Problem

A local family-owned plastic cup manufacturer wants to optimize their production mix in order to maximize their profit. They produce personalized beer mugs and champagne glasses. The profit on a case of beer mugs is $25 while the profit on a case of champagne glasses is $20. The cups are manufactured with a machine called a plastic extruder which feeds on plastic resins. Each case of beer mugs requires 20 lbs. of plastic resins to produce while champagne glasses require 12 lbs. per case. The daily supply of plastic resins is limited to at most 1800 pounds. About 15 cases of either product can be produced per hour. At the moment the family wants to limit their work day to 8 hours.

**Solution**

**Variables:**

* x: be the number of cases of beer mugs to produce
* y: be the number of cases of champagne glasses to produce per day.

**Objective Function:**

Objective: The primary objective of PLASTIC CUP FACTORY is to optimize their production mix in order to maximize profitability while adhering to their values of sustainability and community involvement. This involves carefully balancing the production of personalized beer mugs and champagne glasses, taking into consideration factors such as profit margins, resource utilization, and production constraints.

Maximize profit where profit, Z = 25x + 20y

**Constraints:**

1. Plastic Resins Constraint: The daily supply of plastic resins is limited to at most 1800 pounds  
   20x + 12y <=1800
2. Production Time Constraint: 15 cases of either product can be produced per hour, and they want to limit their workday to 8 hours.  
   1/15x + 1/15y <= 8

**Python Solution:**

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from scipy.optimize import linprog

# Matrix relating to constraints derieved

lhs         = [[20, 12], [1/15, 1/15]]

# RHS of contraints

rhs         = [1800, 8]

# Objective Function

objective   = [-25, -20]

result      = linprog(c=objective, A\_ub=lhs, b\_ub=rhs,

                 bounds=[(0, None), (0, None)],

                 method='simplex')

x           = result.x

print(f"Beer mugs: {x[0]}")

print(f"Cases of Champagne: {x[1]}")

**Solution:**

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**Conclusion:**

In conclusion, PLASTIC CUP FACTORY faces the challenge of efficiently utilizing its limited resources to maximize profit without compromising on product qualityBy carefully analyzing the constraints and profit margins associated with producing beer mugs and champagne glasses, PLASTIC CUP FACTORY can make informed decisions on the ideal production mix to achieve their objectives.

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