Optimization

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INTRODUCTION

Problem Statement 7.8:

- A cooperative society of farmers has 50 hectare of land to grow two crops X and Y.
- The profit from crops X and Y per hectare are estimated as Rs 10,500 and Rs 9,000 respectively.
- To control weeds, a liquid herbicide has to be used for crops X and Y at rates of 20 litres and 10 litres per hectare and no more than 800 litres of herbicide should be used
- How much land should be allocated to each crop so as to maximise the total profit of the society?

Decision Variables and Objective Function

Decision Variables:

- : X: Number of hectares of land in which 'x' is cultivated
- : Y: Number of hectares of land in which 'y' is cultivated

Objective Function:

- Profit = Profit from x per hectare * X
  +
  Profit from y per hectare * Y

$$Profit_{max} = 10500 * X + 9000 * Y$$

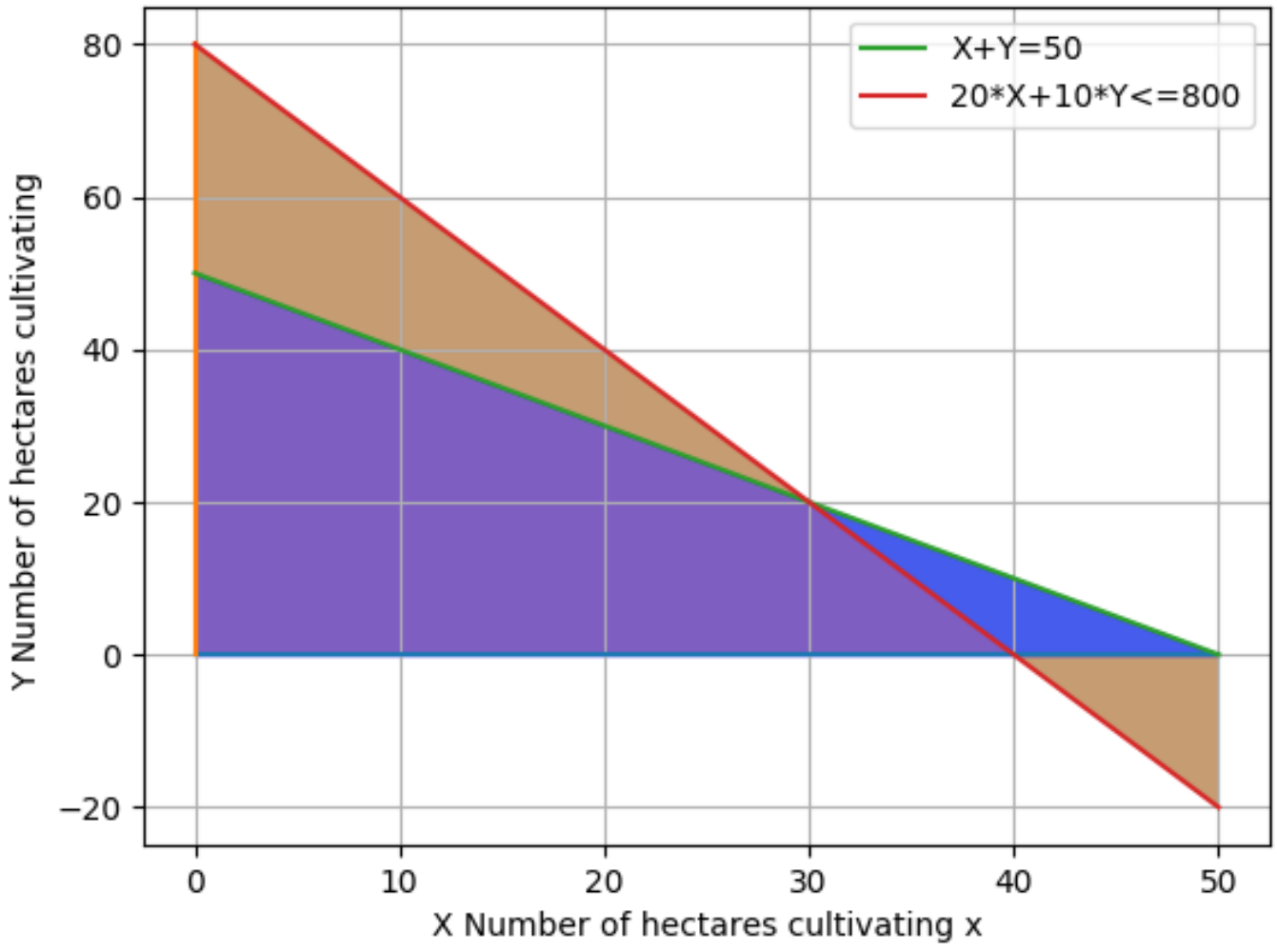
Constraints

$$\mathbf{X + Y = 50} \tag{1}$$

$$\mathbf{20 * X + 10 * Y <= 800} \tag{2}$$

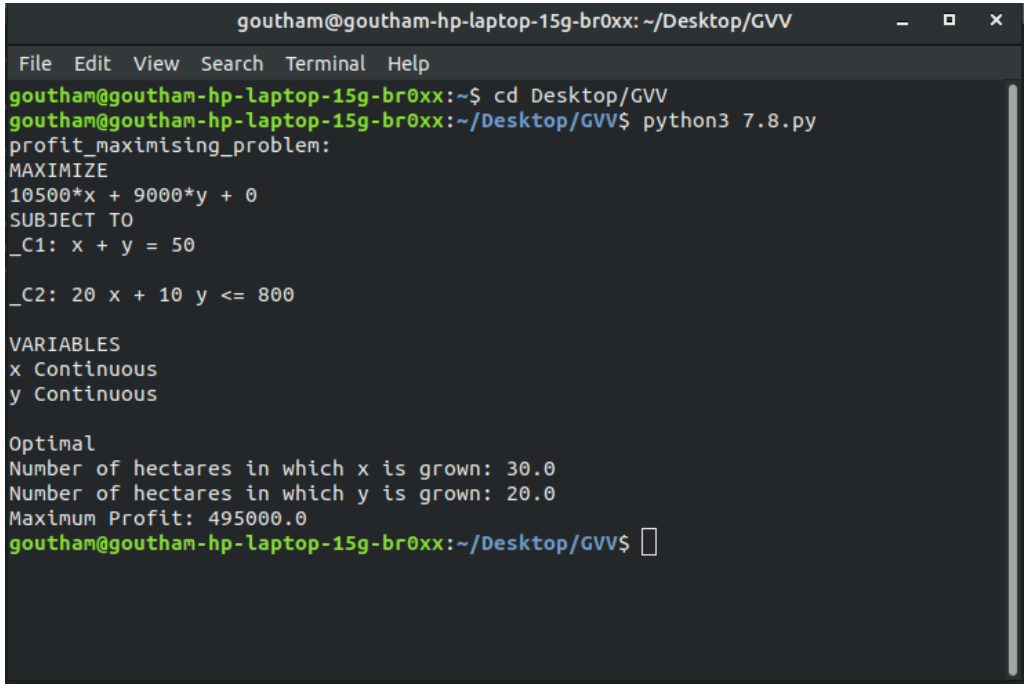
- Constraint (1) indicates the total number of hectares available to cultivate both X and Y in our mission to maximise profit.
- Constraint (2) ensures that the total amount of herbicide used for cultivating is no more than 800 litres

Graph


X+Y=50
20*X+10*Y<=800
80
60
40
20
0
−20
0
10
20
30
40
50
Y Number of hectares cultivating
X Number of hectares cultivating x

Solution

Number of hectares with x crop = 30
Number of hectares with y crop = 20
Total Profit = 495000



Code for this problem can be accessed here