Optimization Assignment - 1

Bole Manideep

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Problem Statement - **One kind of cake requires 200g of flour and 25g of fat, and another kind of cake requires 100g of flour and 50g of fat. Find the maximum number of cakes which can be made from 5kg of flour and 1 kg of fat assuming that there is no shortage of the other ingredients used in making the cakes.**

Solution

Let x,y be the number of cakes of first kind & second kind that can be made from the given amount of floor & fat respectively.

Kind of cake	No. of cakes	Flour (in gm)	Fat (in gm)
$Cake_1$	x	200	25
$Cake_2$	y	100	50

Table 1

Given, 5 kg of flour and 1 kg of fat is available for prepation of cakes.
Implies,total amount of flour in both cakes should'nt exceed 5000g and also total fat should'nt exceed 1000g

$$200x + 100y \leq 5000 \tag{1}$$
$$100x + 50y \leq 1000 \tag{2}$$

Let P be the maximum number of cakes that can be made from the given amount of flour and fat. The problem can be formulated as

$$P = \max_{x,y}(x + y) \tag{3}$$

which can be expressed in vector form as

$$P = \max_{\mathbf{x}} \begin{pmatrix} 1 & 1 \end{pmatrix} \mathbf{x} \tag{4}$$
$$\begin{pmatrix} 200 & 100 \\ 100 & 50 \end{pmatrix} \mathbf{x} \leq \begin{pmatrix} 5000 \\ 1000 \end{pmatrix} \tag{5}$$
$$\mathbf{x} \geq \mathbf{0} \tag{6}$$

Solving the above equations using cvxpy, we get

$$P_{max} = 30 \tag{7}$$
$$\mathbf{x} = \begin{pmatrix} 20 \\ 10 \end{pmatrix} \tag{8}$$