

OPTIMIZATION

EE18ACMTECH11005,EE18MTECH11026

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Objective:

To find the solution to the given optimization problem using the method of Lagrange multipliers.

$$\max_x 6x_1 + 5x_2$$

with constraints $x_1 + x_2 < 5$

$$3x_1 + 2x_2 < 12$$

where $x_1, x_2 > 0$

Solution:

$$L(x_1, x_2, \lambda, \mu) = -6(x_1 + 5x_2) + \lambda(x_1 + x_2 - 5) + \mu(3x_1 + 2x_2 - 12)$$

$$\Delta L(x_1, x_2, \lambda, \mu) = \begin{Bmatrix} -6 + \lambda + 3\mu \\ -5 + \lambda + 2\mu \\ x_1 + x_2 - 5 \\ 3x_1 + 2x_2 - 12 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix}$$

Putting in matrix form we get:

$$\begin{Bmatrix} 0 & 0 & 1 & 3 \\ 0 & 0 & 1 & 2 \\ 1 & 1 & 0 & 0 \\ 3 & 2 & 0 & 0 \end{Bmatrix} \begin{Bmatrix} x_1 \\ x_2 \\ \lambda \\ \mu \end{Bmatrix} = \begin{Bmatrix} 6 \\ 5 \\ 5 \\ 12 \end{Bmatrix}$$

Solution

on Solving we get:

$$\begin{Bmatrix} x_1 \\ x_2 \\ \lambda \\ \mu \end{Bmatrix} = \begin{Bmatrix} 2 \\ 3 \\ 3 \\ 1 \end{Bmatrix}$$

$$\max_x 6x_1 + 5x_2 = 27$$