

# OPTIMIZATION

EE18ACMTECH11005,EE18MTECH11026

February 21 2019

## Objective:

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

$$\begin{aligned} & \max_x 6x_1 + 5x_2 \\ & \text{with constraints } x_1 + x_2 < 5 \\ & 3x_1 + 2x_2 < 12 \\ & \text{where } x_1, x_2 > 0 \end{aligned}$$

## Solution:

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

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

Putting in matrix form we get:

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

# Solution

on Solving we get:

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

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