ME 782 Design Optimization, Assignment #7, September 23, 2024

Determine the value of the variables that will obtain constrained local minima of the following functions using the appropriate penalty functions using the analytical method

1. $f(x_1, x_2) = 4x_1^2 + 3x_2^2 - 5x_1x_2 - 8x_1$
Subject to $x_1 + x_2 = 4$

2. $f(x_1, x_2) = 9x_1^2 + 18x_1x_2 + 13x_2^2 - 4$
Subject to $x_1^2 + x_2^2 + 2x_1 = 16$

3. $f(x_1, x_2) = (x_1 - 1)^2 + (x_2 - 1)^2$
Subject to $x_1 + x_2 - 4 = 0$

4. $f(x_1, x_2) = 2x_1 + 3x_2 - x_1^3 - 2x_2^2$
Subject to $\begin{array}{l} x_1 + 3x_2 \le 6 \\ 5x_1 + 2x_2 \le 10 \end{array}$

5. $f(x_1, x_2) = 4x_1^2 + 3x_2^2 - 5x_1x_2 - 8x_1$
Subject to $x_1 + x_2 \le 4$

6. $f(x_1, x_2) = x_1^2 + x_2^2 - 4x_1 - 2x_2 + 6$
Subject $4 - x_1 - x_2 \le 0$

7 $f(x_1, x_2) = 2x_1^2 - 6x_1x_2 + 9x_2^2 - 18x_1 + 9x_2$
Subject $\begin{array}{l} x_1 + 2x_2 \le 10 \\ 4x_1 - 3x_2 \le 20 \end{array}$

8 $f(x_1, x_2) = 9x_1^2 - 18x_1x_2 + 13x_2^2 - 4$
Subject to $16 - x_1^2 - x_2^2 - 2x_1 \le 0$

9 $f(x_1, x_2) = (x_1 - 3)^2 + (x_2 - 3)^2$
Subject to $\begin{array}{l} x_1 + x_2 \le 4 \\ x_1 - 3x_2 = 1 \end{array}$

10 $f(x_1, x_2) = x_1^3 - 16x_1 + 2x_2 - 3x_2^2$
Subject to $x_1 + x_2 \le 3$