CE 213 Systems Techniques in Water Resources Engg

Assignment -1

1. Locate the stationary points, if any, and the global optimum of the following functions. Determine if each function is convex or concave.

   a. $f(X) = 6x^4 + 8x^3$
   b. $f(X) = 3x^2 - 5x + 6$
   c. $f(X) = x^3 - x - x^2$

2. Locate the desired optimum of the following functions of multiple variables:

   a. $Minimize\ f(X) = 2x_1^2 + 2x_2^2 + x_1x_2 - 6x_1$
   b. $Minimize\ f(X) = x_1^2 + x_2^2 + x_1x_2 + x_2^3$
   c. $Maximize\ f(X) = 8x_1^3 - x_1^2 + x_1x_2 - 7x_2$

3. $Minimize\ f(X) = 5x_1^2 + 2x_2 - x_1x_2 \qquad subject\ to\ x_1 + x_2 = 3$

4. $Minimize\ f(X) = x_1^2 + x_2^2 \qquad subject\ to\ x_1 - x_2 = 5$

5. $Optimize\ f(X) = -x_1^2 - x_2^2 + 4x_1 + 6x_2\ subject\ to\ x_1 + x_2 \le 2\ and\ -2x_1 - 3x_2 + 12 \ge 0$
   $Solution: f_{max}(X) = 17/2;\ x_1 = 1/2\ and\ x_2 = 3/2$

6. $Optimize\ f(X) = -2x^2 + 5xy - 4y^2 + 18x\ \ subject\ to\ x + y \le 7$
   $Solution: f_{max}(X) = 74.02;\ x_1 = 109/22\ and\ x_2 = 45/22$

7. $Minimize\ f(X) = (x_1 - 5)^2 + 4\,x_1 + x_2{}^2\ subject\ to\ x_1 + 2x_2 \ge 5\ and\ x_1 + 5x_2 \le 7$
   $Solution: f_{min}(X) = 16.9;\ x_1 = 3.68\ and\ x_2 = 0.67$

8. From the solution obtained for problems 5, 6 and 7, check whether the Kuhn-Tucker conditions are satisfied.

Last date for submission: February 12, 2020.