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جامعة المنوفية، كلية الهندسة الالكترونية

قسم هندسة الالكترونيات الصناعية والتحكم

Exercise 2

2.1 Find the local minimum points using necessary/sufficient conditions:

a. $f(x) = 3x^2 + 2x + 7$
b. $f(x) = x^3 + 2x^2 - 3x - 6$
c. $f(x) = 20/x + 5x$
d. $f(x) = cosx$
e. $f(x) = x^2 e^{-x}$

2.2 Find the local minimum points using necessary/sufficient conditions:

a. $f(x_1, x_2) = 3{x_1}^2 + 2x_1x_2 + 2{x_2}^2 + 7$
b. $f(x_1, x_2) = {x_1}^2 + x_1x_2 + {x_2}^2$
c. $f(x_1, x_2) = 7{x_1}^2 - x_1 + 12{x_2}^2$
d. $f(x_1, x_2) = 25{x_1}^2 + 20{x_2}^2 - 2x_1 - x_2$

2.3 Find the candidate local minimum points using necessary conditions:

a. Minimize $f(x_1, x_2) = 4{x_1}^2 + 3{x_2}^2 - 5x_1x_2 - 8x_1$,
   Subject to $x_1 + x_2 = 4$
b. Minimize $f(x_1, x_2) = (x_1 - 2)^2 + (x_2 + 1)^2$,
   Subject to $2x_1 + 3x_2 - 4 = 0$
c. Maximize $f(x_1, x_2) = 4{x_1}^2 + 3{x_2}^2 - 5x_1x_2 - 8$,
   Subject to $x_1 + x_2 = 4$
d. Minimize $f(x_1, x_2) = 4{x_1}^2 + 9{x_2}^2 + 6x_2 - 4x_1 + 13$,
   Subject to $x_1 - 3x_2 + 3 = 0$

2.4 Find the candidate local minimum points using KKT necessary conditions:

a. Minimize $f(x_1, x_2) = 4{x_1}^2 + 3{x_2}^2 - 5x_1x_2 - 8$,
   Subject to $x_1 + x_2 \leq 4$
b. Maximize $f(x_1, x_2) = 4{x_1}^2 + 3{x_2}^2 - 5x_1x_2 - 8$,
   Subject to $x_1 + x_2 \leq 4$
c. Minimize $f(x_1, x_2) = {x_1}^3 - 16x_1 - 3{x_2}^2 + 2x_2$,
   Subject to $x_1 + x_2 \leq 3$
d. Minimize $f(x_1, x_2) = {x_1}^2 + {x_2}^2 - 4x_1 - 2x_2 + 6$,
   Subject to $x_1 + x_2 \geq 4$

e. Minimize $f(x_1, x_2) = (x_1 - 1)^2 + (x_2 - 1)^2$,
   Subject to $x_1 + x_2 \geq 4$ and $x_1 - x_2 = 2$
f. Minimize $f(x_1, x_2) = (x_1 - 1)^2 + (x_2 - 1)^2$,
   Subject to $x_1 + x_2 \geq 4$ and $x_1 - x_2 \geq 2$

2.5 Consider the following problem with equality constraints:

Minimize $f(x_1, x_2) = (x_1 - 1)^2 + (x_2 - 1)^2$

Subject to $x_1 + x_2 - 4 = 0$ and $x_1 - x_2 - 2 = 0$

a. Is it a valid optimization problem? Explain.
b. Explain how you would solve the problem? Are necessary conditions needed to find the optimum solution?