Homework 2

Due : 2020.04.27. 10:00

1. Set $\vec{x}_{(0)} = (9, 1)$ and $f(x_1, x_2) = \frac{1}{2}(x_1^2 + 9x_2^2)$

$$= \frac{1}{2}(x_1\ x_2)\begin{pmatrix} 1 & 0 \\ 0 & 9 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}.$$

Write a python code that finds the minimum of $f(x_1, x_2)$ by "Gradient Descent (GD) method". (10 pts)

ⓐ A step size $t > 0$ can be choosen to be small enough

or by "exact line search" algorithm. (+α pts) (Bonus credit!)

Survey & apply

ⓑ Max iteration $= 100$

Stopping Criterion => $\|f(\vec{x}_{(k+1)}) - \vec{x}_{(k)}\|_2 < \varepsilon = 10^{-5}$

제출 파일 명 : name_student number_HW2.py

ex) byungjoon_200713693_HW2.py

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2. Solve the following optimization problems. (15 pts) #2

ⓐ minimize x^2+2y^2

subject to $x^2+y^2=1$

ⓑ minimize $(x-3)^2+(y-1)^2+(z+1)^2$

subject to $x^2+y^2+z^2=4$

ⓒ maximize $x+2y+3z$

subject to $x-y+z=1$

$x^2+y^2=1$

Hint : Method of Lagrange Multiplier!

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3. Calculate the Lagrangian $L(x,\lambda)$ and the Lagrangian dual $g(\lambda)$ for the followings. (10 pts)

ⓐ minimize $x+2020$

subject to $\frac{1}{2}x^2 \leq 0$

ⓑ minimize x^2+y^2

subject to $x+y-6 \geq 0$

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#3

4. Show that the Lagrangian dual function

$g(\lambda, \nu)$ is concave for (λ, ν). (5pts)