Assignment 02

Find the global minimum point & value for the function

$$f(x,y) = x^2 + y^2 + 10$$

⇒ Do manual calculations for two iterations

⇒ Find the optimal solution using python programming
↳ Done in google colab _pynb file_

step1 $f(x,y) = x^2 + y^2 + 10$ (Initialization)

$x=1, y=1,$ epochs $= 2,$ iter $= 1, \eta = 0.01$

step2 $\dfrac{\partial f}{\partial x} = 2x + 0$ $\dfrac{\partial f}{\partial y} = 2y$

$\left.\dfrac{\partial f}{\partial x}\right|_{x=1} = 2(1) = 2$ $\left.\dfrac{\partial f}{\partial y}\right|_{y=1} = 2(1) = 2$

Calculate Gradient w.r.to x | Calculate Gradient w.r.to y

step3 Update (Find step length

$\Delta x = -\eta \dfrac{\partial f}{\partial x}$ $\Delta y = -\eta \dfrac{\partial f}{\partial x y}$

$= -(0.01)(2)$ $= -(0.01)(2) = -0.02$

$= -0.02$

step4 Update variable

$x = x + \Delta x$ $y = y + \Delta y$

$= 1 + (-0.02)$ $= 1 + (-0.02)$

$= 0.98$ $= 0.98$

step5 iter = iter + 1 = 2

step6 if (iter > epochs)

$2 > 2$ X (no)

goto step2

Step2 $\frac{\partial f}{\partial x}\Big|_{x=0.98} = 2(0.98)$ $\quad \frac{\partial f}{\partial y}\Big|_{y=0.98} = 2(0.98)$

$= 1.96$ $\quad = 1.96$

= Step3 step length

$$\Delta x = -\eta \frac{\partial f}{\partial x}$$ $\quad \Delta y = -\eta \frac{\partial f}{\partial y}$

$$= -(0.01)(1.96)$$ $\quad = -(0.01)(1.96)$

$$\Delta x = -0.0196$$ $\quad \Delta y = -0.0196$

Step4 Update variable

$$x = x + \Delta x$$ $\quad y = y + \Delta y$

$$= 0.98 + (-0.0196)$$ $\quad = 0.98 + (-0.0196)$

$$= 0.9604$$ $\quad = 0.9604$

Step5 iter = iter+1 = 2+1 = 3

Step6 if (iter > epochs)

$$3 > 2 \checkmark (\text{yes})$$

goto next step

Step7 point

$$x = 0.9604$$

$$y = 0.9604$$

$$f(x,y) = x^2 + y^2 + 10$$

$$= (0.9604)^2 + (0.9604)^2 + 10$$

$$= 0.9223 + 0.9223 + 10$$

$$f(x,y) = 11.844$$