Assignment-4

	x_i^a	y_i^a
$i=1$	7.6	157
$i=2$	7.1	174

$$\min E = \frac{1}{2}(y_i^a - mx_i^a - c)^2$$

step-1:- $[x_i^a, y_i^a]$, $\eta = 0.01$, epoch = 2, $m = 1$, $c = -1$

Iter = 1

Iteration-1

sample-1

step-2

$$\left.\frac{\partial E}{\partial m}\right|_{m=1} = \frac{1}{2} \times 2 (y_i^a - mx_i^a - c) \times (-x_i^a)$$

$$= -(y_i^a - mx_i^a - c) x_i^a$$

$$= -(157 - 1 \times 7.6 + 1)(7.6)$$

$$= -(157 - 6.6)(7.6)$$

$$= -1143.04$$

$$\left.\frac{\partial E}{\partial c}\right|_{c=-1} = \frac{1}{2} \times 2 (y_i^a - mx_i^a - c) \times (-1)$$

$$= -(y_i^a - mx_i^a - c)$$

$$= -(157 - 1 \times 7.6 + 1)$$

$$= -(157 - 6.6) = -150.4$$

Step-3

$$\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.01)(-1143.04)$$

$$= 11.4304$$

$$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.01)(-150.4)$$

$$= 1.504$$

Step-4 :-

$$m = m + \Delta m = 1 + 11.4304 = 12.4304$$

$$c = c + \Delta c = -1 - 1.504 = -2.504$$

Step-5 :- update the sample $i = i+1 = 1+1 = 2^{nd}$ sample

Sample-2

Step-2

$$\frac{\partial E}{\partial m}\Big|_{m=12.4304} = -(y_i^2 - mx_i^2 - c)\, x_i^2$$

$$= -(174 - (12.4304)(7.1) + 2.504)(7.1)$$

$$= -626.56$$

$$\frac{\partial E}{\partial c}\Big|_{c=-2.504} = -(y_i^2 - mx_i^2 - c)$$

$$= -(174 - (12.4304)(7.1) + 2.504)$$

$$= -88.24$$

Step-3 :-

$$\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.01)(-626.56)$$

$$= 6.2656$$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.01)(-88.24) = 0.8824$

Step-4

$m = m + \Delta m = 12.4304 + 6.2656 = 18.696$

$c = c + \Delta c = -2.504 + 0.8824 = -1.6216$

Step-5 :- $i = i+1 = 2+1 = 3 > n_s = 2$

Step-6 :- $iter = iter+1 = 2 >$ epochs.

Iteration-2

Sample-1

$i = 1$

Step-2

$\frac{\partial E}{\partial m}\Big|_{m=18.696} = -(y_i^q - m x_i^q - c) x_i^q$

$= -(157 - (18.696)(7.6) + 1.6216)(7.6)$

$= -125.64$

$\frac{\partial E}{\partial c}\Big|_{c=-1.6216} = -(y_i^q - m x_i^q - c)$

$= -(157 - (18.696)(7.6) + 1.6216)$

$= -16.532$

Step-3

$\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.01)(-125.64)$

$= 1.2564$

$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.01)(-16.532)$

$= 0.165$

Step-4 :-

$m = m + \Delta m = 18.696 + 1.2564 = 19.9524$

$c = c + \Delta c = -1.6216 + 0.165 = -1.4566$

Sample-2

i=2

Step-2

$$\frac{\partial E}{\partial m}\Big|_{m=19.9524} = -(y_i^2 - mx_i^2 - c)x_i^2$$

$$= -(174 - (19.9524)(7.1) + 1.4566)(7.1)$$

$$= -239.94$$

$$\frac{\partial E}{\partial c}\Big|_{c=-1.4566} = -(y_i^2 - mx_i^2 - c)$$

$$= -(174 - (19.9524)(7.1) + 1.4566)$$

$$= -33.79$$

Step-3 :-

$$\Delta m = -\eta \frac{\partial E}{\partial m} = -(0.01)(-239.94)$$

$$= 2.399$$

$$\Delta c = -\eta \frac{\partial E}{\partial c} = -(0.01)(-33.79)$$

$$= 0.3379$$

step-4 :-

$m = m + \Delta m = 19.9524 + 2.399 = 22.3514$

$c = C + \Delta C = -1.4566 + 0.3379 = -1.1187$.

step-5 :- $i = i+1 = 2+1 = 3 > n_s = 2$

step-6 :- $iter = iter+1 = 2+1 = 3 > epochs$