II. Linear regression with one variable

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1 Question 6

x	y
3	2
1	2
0	1
4	3

Gradient descent:

$$\theta_0 = \theta_0 - \alpha \times \frac{1}{m}\sum_{i=1}^{m}(h_\theta(x^{(i)}) - y^{(i)}) \tag{1}$$

As there are 4 training samples, we have: m = 4.
When plotting the points represented in the table above, the most fitting hypothesis should be comparable to y = 1 + 0.5x, so let's choose

$$\theta_0 = 1 \, and \, \theta_1 = 0.5. \tag{2}$$

Choice for $\alpha : \alpha = 0.1$.

with:

$$h_\theta(x^{(i)}) = \theta_0 + \theta_1 \times x^{(i)} \tag{3}$$

so, filling in the point coordinates:
h$_\theta(0) = 1 + 0.5 \times 0 = 1$
$h_\theta(1) = 1 + 0.5 \times 1 = 1.5$
$h_\theta(3) = 1 + 0.5 \times 3 = 2.5$
$h_\theta(4) = 1 + 0.5 \times 4 = 3$

and:
$\theta_0 = \theta_0 - \alpha \times \frac{1}{m}\sum_{i=1}^{m}(h_\theta(x^{(i)}) - y^{(i)})$
$= 1 - 0.1 \times \frac{1}{4} \times ((h_\theta(0) - 1) + (h_\theta(1) - 2) + (h_\theta(3) - 2) + (h_\theta(4) - 3))$
$= 1$

$\theta_1 = \theta_1 - \alpha \times \frac{1}{m}\sum_{i=1}^{m}(h_\theta(x^{(i)}) - y^{(i)})$
$= 0.5 - 0.1 \times \frac{1}{4} \times ((h_\theta(0) - 1) + (h_\theta(1) - 2) + (h_\theta(3) - 2) + (h_\theta(4) - 3))$
$= 0.475$

conclusion:
$\mathrm{h}_\theta(x^{(i)}) = 1 + 0.475 \times x^{(i)}$