# gradient descent for multi-variable functions

## Problem 1

$J(\theta_1, \theta_0) = \theta_1^{\ 2} + \theta_0^{\ 2} + 2$

$\alpha = 0.25, \qquad$ initial point $\begin{bmatrix} \theta_0 = 2 \\ \theta_1 = 4 \end{bmatrix}$, $\qquad$ 10 iterations

Write a Matlab script that will help you find an approximation for $\begin{bmatrix} \theta_0 \\ \theta_1 \end{bmatrix}$ that minimizes $J(\theta_1, \theta_0)$, given the above $\alpha$ and initial point and number of iterations.

What is your guess? Looking at the progression of $\begin{bmatrix} \theta_0 \\ \theta_1 \end{bmatrix}$ values, what point do you think actually minimizes $J(\theta_1, \theta_0)$?

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## Problem 2

$J(\theta_1, \theta_0) = 38\theta_1^{\ 2} + 3\theta_0^{\ 2} + 20\theta_1\theta_0 - 42\theta_1 - 12\theta_0 + 14$

$\alpha = 0.01, \qquad$ initial point $\begin{bmatrix} \theta_0 = 1.5 \\ \theta_1 = 0.5 \end{bmatrix}$, $\qquad$ 5 iterations

Write a Matlab script that will help you find an approximation for $\begin{bmatrix} \theta_0 \\ \theta_1 \end{bmatrix}$ that minimizes $J(\theta_1, \theta_0)$, given the above $\alpha$ and initial point and number of iterations.

What is your guess? Looking at the progression of $\begin{bmatrix} \theta_0 \\ \theta_1 \end{bmatrix}$ values, what point do you think actually minimizes $J(\theta_1, \theta_0)$?

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## Problem 3

$J(\theta_2, \theta_1, \theta_0) = \theta_2^{\ 2} + 0.25\theta_1^{\ 2} + 3\theta_0^{\ 2} + 2\theta_2\theta_0 + \theta_1\theta_0 - 2\theta_0 + 3$

$\alpha = 0.2, \qquad$ initial point $\begin{bmatrix} \theta_0 = 3 \\ \theta_1 = 4 \\ \theta_2 = 5 \end{bmatrix}$, $\qquad$ 100 iterations

Write a Matlab script that will help you find an approximation for $\begin{bmatrix} \theta_0 \\ \theta_1 \\ \theta_2 \end{bmatrix}$ that minimizes $J(\theta_2, \theta_1, \theta_0)$, given the above $\alpha$ and initial point and number of iterations.

What is your guess? Looking at the progression of $\begin{bmatrix} \theta_0 \\ \theta_1 \\ \theta_2 \end{bmatrix}$ values, what point do you think actually minimizes $J(\theta_2, \theta_1, \theta_0)$?

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