Homework2

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1 Armijo Gradient

$f(x) = x^2 exp(-x) - x$
$x0 = 0.5$ and $x0 = 2$
To calculate Armijo gradient algorithm, I've assumed α as a random number betrween 0 and 1.

Step 1. Compute the Descent Direction
$h_i = h(x_i) = - \bigtriangledown f(x_i)$
Stop if $\bigtriangledown f(x_i) = 0$
$\bigtriangledown f(x) = -x^2 exp(-x) + 2exp(-x)x - 1$

Step 2. Compute the step size
Find the max argument of α_m, set it as λ
$f(x_k + \alpha_m d_k) \leq f(x_k) + \alpha_m \beta \nabla f(x_k)^T d_k$
$\lambda \in (0, 2(1 - \alpha/M)$ where M is larger then Double differential of f(x).

Step 3. Update x
$x_i + 1 = x_i + \lambda h_i$
and go back to step 1.
$f(x_k + \alpha_m d_k) \leq f(x_k) + \alpha_m \beta \nabla f(x_k)^T d_k$
$\leq \lambda \parallel \bigtriangledown f(x_i)^2 \parallel (M/2\lambda - (1 - \alpha))$
by mean value Theorem

$\lambda \in (0, 2(1 - \alpha)/M)$
To calculate armijo gradient algorithm when $\mathrm{x}_0 = 0.5$,h_0 becomes -0.5451.
$[h_1, h_2, h_3...] = [-0.02001627842295628, -2.658723154969067e{-}07, -1.3633538742396922e{-}12, 0.0, 0.0, , ,]$

Eventually, h_i converges to be 0.

When $\mathrm{x}_0 = 2$,
$[\mathrm{h}_1, h_2, h_3...] = [-5.0693825587533325, -3.5393665775984573e{-}07, -1.5543122344752192, 0.0, 0.0, , ,]$

Eventually, h_i converges to be 0.