CS412 Machine Learning - 2023
HW3-Gradient Descent
50pts

1) **50pts -** We are trying to minimize a function $F(x) = x^2 - 10x + 5$ with respect to its parameter x. In other words we want to find the x for which f(x) is minimum.

   Starting from the point x=10 use steepest descent algorithm *for TWO steps* to find the local minimum of the function around this point. You should use a "step size" of α = 0.1 in update, as: $x = x - α \times \nabla$

   We will use a subscript to indicate the subsequent values of x, starting from x_0.

   Worksheet*:*

   $F(x_0) = 10^2 - 10*10 + 5 = 5$ *: Just to note at what F value we start (5pts)*

   $\nabla F = F'(x) = [2x - 10]$ *: Compute the gradient (10pts)*

   Note: Even though F is a function of a single variable, you can still write/think of the gradient as a vector of size one.

   $\nabla F | x_0 = 2*10 - 10 = 10$ *: This is the gradient **evaluated** at x_0 (10pts)*

   $x_1 = x_0 - α \nabla F | x_0 = 10 - 0.1*10 = 9$ *:Update x_0 to find x_1 (5pts)*

   $F(x_1) = 9^2 - 10*9 + 5 = -4$ *: just checking to see if we are indeed minimizing*

   Now do the 2nd step similarly and write your results below (no partial so be careful please):   :20pts

   ANSWER: x_2 (x after 2 steps of gradient descent)= $x_2 = x_1 - α \nabla F | x_1 = 9 - 0.1*8 = 8.2$
   $f(x_2) = (8.2)^2 - 10*8.2 + 5 = -9.76$

Submission: Write the ANSWER line as inline submission to homework and attach the filled page as a pdf document to Sucourse.