**CS412 Machine Learning - 2023**

HW3-Gradient Descent

50pts

1. **50pts -** We are trying to minimize a function F(x) = x2 - 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 a = 0.1 in update, as: x =x – a x ∇

We will use a subscript to indicate the subsequent values of x, starting from x0.

**Worksheet***:*

*F(x0) = 10^2 – 10\*10 + 5 = 100-100+5 = 5 : Just to note at what F value we start (5pts)*

*= [dF(x)/dx] = [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.

| *x0 = 2\*10 – 10 = 10: This is the gradient* ***evaluated*** *at x0 (10pts)*

*x1= x0*  – a x ∇ *= 10 – (0.1)\*10 = 9 :Update x0 to find x1 (5pts)*

*F(x1) = F(9) = 81 – 90 + 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**: x2 (x after 2 steps of gradient descent)= 9 – (0.1)\*8 = 8.2 f(x2) = (8.2)^2 – 82 + 5 = - 9.76

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