

EECS545 Lecture 4 Quiz Solutions

1. Which of the following is a disadvantage of Newton's method compared to gradient descent?:
 - (a) Newton's method usually takes more iterations than gradient descent to converge.
 - (b) Newton's method takes more time to compute on an individual iteration than gradient descent.
 - (c) Newton's method does not always find the optimum for a convex function.
 - (d) Newton's method requires more training data to apply, compared to the gradient descent.

Solution: (b). Need to perform matrix inversion (which is expensive) in Newton's method but not in gradient descent.

2. Suppose we run one iteration of Newton's method on $f(x) = x^3 - 2x^2 + 4$ (in the interval $[0, 5]$). If $x_0 = 2$, what will be the first approximation x_1 ? Hint: start from computing the first derivative. (note: any answer within the error bound of 0.01 will be marked as correct.)

Solution: $f'(x) = 3x^2 - 4x$ $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 2 - \frac{4}{4} = 1$

3. Continued from Q2. What would be the second approximation x_2 ?

Solution: $x_2 = x_1 - \frac{f(x_1)}{f'(x_1)} = 1 - \frac{3}{-1} = 4$

4. (True/False) Logistic regression learns a non-linear decision boundary because the logistic function is non-linear.

Solution: False. Logistic regression learns a linear decision boundary in the feature space. In other words, when you use x as features, then the decision boundary is a linear function of x . If you use non-linear function $\phi(x)$ as features, the decision boundary can be non-linear function of x , but this is not because the logistic function is non-linear.