Quiz 1

ssion: 2025-2026 Semester: Monsoon

ime: 20 minutes **NECD509/ECO506: Machine Learning** Maximum Marks: 10

1. Let us consider n training examples $\{x^{(i)}, y^{(i)}\}, i = 1, 2, \ldots, n$ depicting the price $y^{(i)}$ for the i^{th} house against the size $x^{(i)}$. Further, we decide to fit the training data with the polynomial function of the form $h_{\bar{\theta}}(x) = \sum_{j=0}^{N} \theta_j x^j$ where N is the polynomial order, and θ_j is the weight associated with the j^{th} order polynomial. In general, we set $N = 10$. Furthermore, we consider the two scenarios, i.e., scenario A and B. In scenario A, we have a sufficiently large amount of training data samples, i.e., $n >> N$ whereas in scenario B, we have a limited number of training data samples, i.e., $n \approx N$. Considering both the scenarios, we further move on to run the gradient descent algorithm so as to minimize the mean squared error cost function $J(\bar{\theta})$. Based on this, answer the following questions.

   - What trend can we expect for the training error as well as testing error in both the scenarios? 3 marks
   - Suggest the appropriate modifications in the cost function $J(\bar{\theta})$ if the algorithm works very poorly on the testing data in any of these scenarios? 3 marks
   - Based on the modified cost function, derive the update rule for θ's considering both the batch gradient descent as well as stochastic gradient descent algorithm. 4 marks