# Deep Learning for Perception
## Assignment # 1

**Due Date: 21ˢᵗ Feb 2025**                                    **Total Marks: 50**

1. [20 Points] Draw 3-layer Neural Networks (Input layer is not counted here)with 2 nodes in each hidden layer and 1 output node. Input size is 3. Activation function is relu for 1st hidden layer and sigmoid for 2nd hidden and last layer. Write mathematical equations of all hidden and output layer nodes for a forward pass.  Write down mathematical equations of the partial derivative of Loss w.r.t. all weights and bias for a backward pass. Simplify all these equations. Use (i) Squared Loss (ii) Cross Entropy Loss

2. [10 Points] Draw 2-layer Neural Networks with 1 node in the hidden layer and 2 output nodes. Input size is 2.  The activation function in the hidden layer is tanh while in the output layer, sigmoid is used. Write mathematical equations of all hidden and output layer nodes for a forward pass.  Write down mathematical equations of the partial derivative of Loss w.r.t. all weights and bias for a backward pass. Simplify all these equations. Use Cross Entropy Loss.

3. [20 Points] Complete the following exercise using formulas  computed in Question #1 for
   weights of L1
   W1 = [[0.42, 0.72, 0.21], [0.11, 0.3, 0.65 ]]
   B1 =0.01 (for all neurons)
   weights of L2
   W2 = [[0.17, 0.29], [0.91, 0.08 ]]
   B1 =0.05 (for all neurons)
   weights of L3
   W3 = [[0.61, 0.39]] B1 =0.08
   Learning rate = 0.7
   (i) Squared Loss Function
   (ii) Cross Entropy Loss Function

| F1 | F2 | F3 | Class |
|---|---|---|---|
| 4ᵗʰ digit of   student ID + 1 | 2 | 2ⁿᵈ digit of   student ID + 1 | A |
| 5 | 8 | 3ʳᵈ digit of   student ID + 1 | B |

**Be like a neural network. Learn from your mistakes :)**