Quiz 2	**Name:** _____
Week 3, Sep./21/2022	**On your left:** _____
CS 280: Fall 2022	**On your right:** _____
Instructor: Lan Xu	

Instructions:
Please answer the questions below. Show all your work. This is an open-book test. NO discussion/collaboration is allowed.

Problem 1. (10 points)

Consider the perceptron algorithm and let us re-write the weight updates as follows:

$$\begin{aligned}
\text{Initialization} &: w_1^+ = w_1^- = 0 \\
\text{Mistakes on positive} &: w_{t+1}^+ = w_t^+ + x \\
\text{Mistakes on negative} &: w_{t+1}^- = w_t^- - x \\
\text{Weight update} &: w_{t+1} = w_{t+1}^+ + w_{t+1}^-
\end{aligned}$$

If the inputs are images from two categories: apple (positive) and banana (negative). What would the final weights of w_T^+ and w_T^- look like as an image after T iterations, and why? What about w_T?

Problem 2. (10 points)

Consider a multiclass logistic regression with L1 regularization as follows:

$$z_l = \sum_{j=1}^{2} w_{lj} x_j + b_l, l = 1, 2$$

$$y_k = \frac{e^{z_k}}{\sum_l e^{z_l}}, k = 1, 2$$

$$\mathcal{L} = -\sum_k t_k \log y_k + \lambda \sum_{i=1}^{2} \sum_{j=1}^{2} ||w_{ij}||_1 + \gamma \sum_{l=1}^{2} ||b_l||_1$$

Draw a computational graph for this network and its loss. Note each node should be a scalar in this graph.

Write down the forward pass based on the graph you have built.