Test

1. Let x be a vector of real numbers. Which of the following operations are equivalent to softmax(x):
    a. softmax(x+(1,...,1))
    b. softmax(2 * x)
    c. softmax(sigmoid(x))
2. Consider a convolutional layer with biases which has 10 filters of size 5x5, with 4 input channels. What is the number of parameters of this layer?
    a. 100
    b. 110
    c. 140
3. Consider a batch norm in a convnet, the input of which has 10 channels, each of size 100x100. How many parameters this layer has?
    a. 10
    b. 20
    c. 100
4. Consider a regular MLP (multi-layer perceptron) architecture with 10 fully connected layers with ReLU activation function. The input to the network is a vector of size 1000, where each dimension has zero mean and standard deviation equal to 1 across the dataset.

    Each hidden layer has 1000 neurons and is initialized from a normal distribution with zero mean and standard deviation 0.01. Which of the following options is the most likely?

    * the gradients will be exploding
    * The gradients will be vanishing
    * Neither.

5. Consider a regular RNN layer **without biases**, with hidden state of size 100, its input elements being vectors of size 10, output elements being vectors of size 10. How many parameters this layer has?
    a. 10200
    b. 11000
    c. 12000

6. Consider a reinforcement learning setting, where the state is represented as two features x_1, x_2, there are two possible actions a_1, a_2, and the agent picks the action a_1 with probability max(0, min(1, f1 * x1 + f2 * x2)) and action a_2 otherwise. Assume only one episode with one turn where the starting state is (x_1=2, x_2=-1), the reward given to

the agent after performing action a_1 is 10, while after performing action a_2 is 0. Consider the gradient of the expected reward of a policy with respect to the parameters f_1, f_2 for two cases (i) f_1=1, f_2=1.5 (ii) f_1=1, f_2=1.25. In which of the cases (i) or (ii) the norm of the gradient is larger?

a. (i)
b. (ii)
c. They are equal.

7. Consider the following 4 datapoints for a classification problem into 2 classes:
(input=(0,0), label=0)
(input=(1,1), label=0)
(input=(0,1), label=1)
(input=(1,0), label=1)
Which of the following MLP architectures can achieve training error of value 0?
    a. Input -> dense layer with 2 neurons -> softmax
    b. Input -> dense layer with 1 neuron -> sigmoid -> dense layer with 2 neurons -> softmax
    c. Input -> dense layer with 2 neurons -> sigmoid -> dense layer with 2 neurons -> softmax

8. Consider a game with 25 coins on the table. In each turn the player can either:

- Take r coins, where 0 <= r <= min(10, #coins left) and receive a reward of r-2.
- End the game - no additional rewards.

What is the q-value q*(a4) (where a4 represents the action of taking 4 coins in the first turn)? Assume there is no discount factor (gamma=1).

a. 16
b. 17
c. 18
d. 19