Graded

Question-1

Statement

Consider the following data and the hypothesis function $h(x) = sign(g(x))$:

g(x)	y
+30	+1
-20	-1
-1	-1
+1	+1

Which of the following will be true?

Options

(a)

The values of 0-1 loss and squared loss will be same, which will be equal to zero.

(b)

The values of 0-1 loss and squared loss will be same, which will be equal to some large positive quantity.

(c)

The value of 0-1 loss will be zero, while the value of squared loss will be some large positive quantity.

(d)

The value of squared loss will be zero, while the value of 0-1 loss will be some large positive quantity.

Answer

(c)

Solution

There is an ambiguity in this question. The given $h(x) = sign(g(x))$ is supposed to be explain the 0-1 loss and not the squared loss. In this case,

g(x)	y	sign(g(x))	0-1 loss	Squared loss ((g(x)-y)^2
+30	+1	+1	0	(29)^2
-20	-1	-1	0	(-19)^2
-1	-1	-1	0	0

g(x)	y	sign(g(x))	0-1 loss	Squared loss ((g(x)-y)^2
+1	+1	-1	0	0

The value of 0-1 loss is zero, while the value of squared loss is a large positive quantity. Hence, option (c) should be correct.

However, since h(x) is stated to be sign(g(x)) and if squared loss is computed on the column 2 and 3 of the above table, squared loss will also come out to be 0, resulting in option (a) to be correct.

Hence, both options (a) and (c) will fetch marks.

Common instructions for questions 2-5

Consider a neural network with the number of neurons in different layers as mentioned in the below list for a regression task:

[5, 5, 4, 3, 1]

Question-2

Statement

How many hidden layers are there in the network?

Answer

3 (No range required)

Solution

The first layer is input layer and the last one is hidden layer. The intermediate 3 layers are hidden layers.

Question-3

Statement

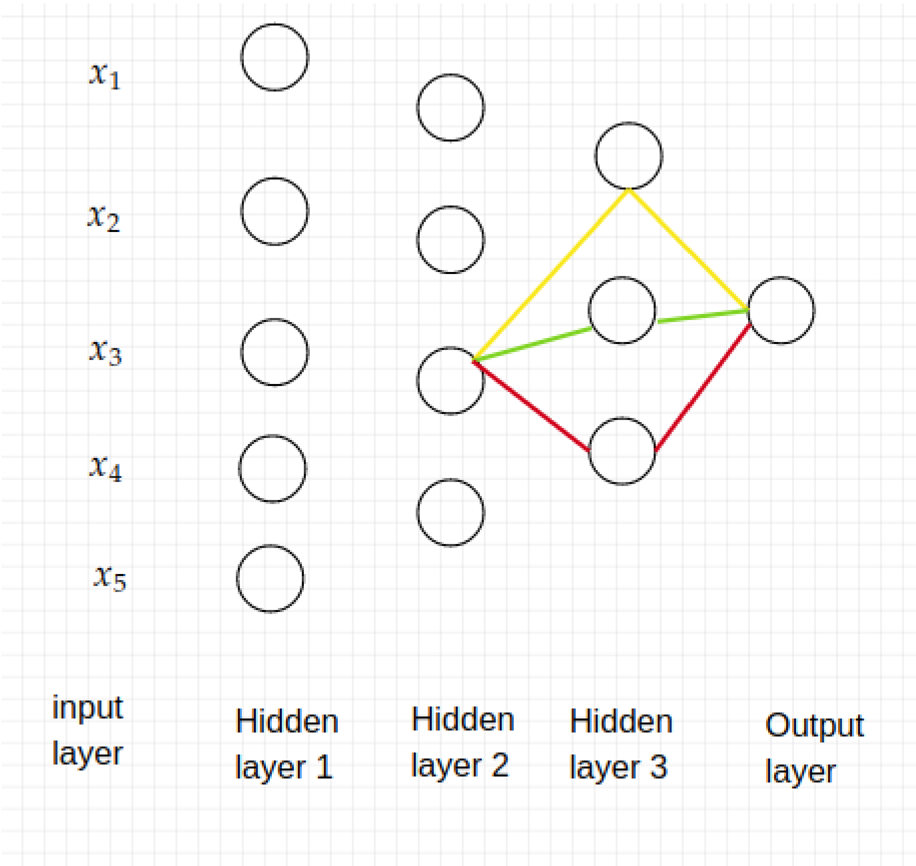
Through how many paths can the 3rd neuron in the 2nd hidden layer affect the final output?

Answer

3 (No range required)

Solution

The three paths are shown below in different colors.



Question-4

Statement

Assuming that there is a bias associated with each neuron, how many total parameters need to be computed?

Answer

73 (No range required)

Solution

#weights from input to hidden layer 1: 5*5 = 25

#weights from hidden layer 1 to hidden layer 2: 5*4 = 20

#weights from hidden layer 2 to hidden layer 3: 4*3 = 12

#weights from hidden layer 3 to output layer: 3*1 = 3

There will be a bias associated withe each neuron except the input layer neurons. (Input layer is used to simply pass on the inputs to the subsequent layers)

#biases = 5+4+3+1 = 13

Total number of parameters = 25+20+12+3+13 = 73

Question-5

Statement

What will be an appropriate activation function for the output layer?

Options

(a)

Sigmoid

(b)

Linear

(c)

ReLU

Answer

(b)

Solution

Sigmoid is used for binary classification at the output layer.

ReLU is mostly used at the hidden layers. (It does not make sense to be used at the output layer.)

Linear is an appropriate activation function for output layer in a regression problem.

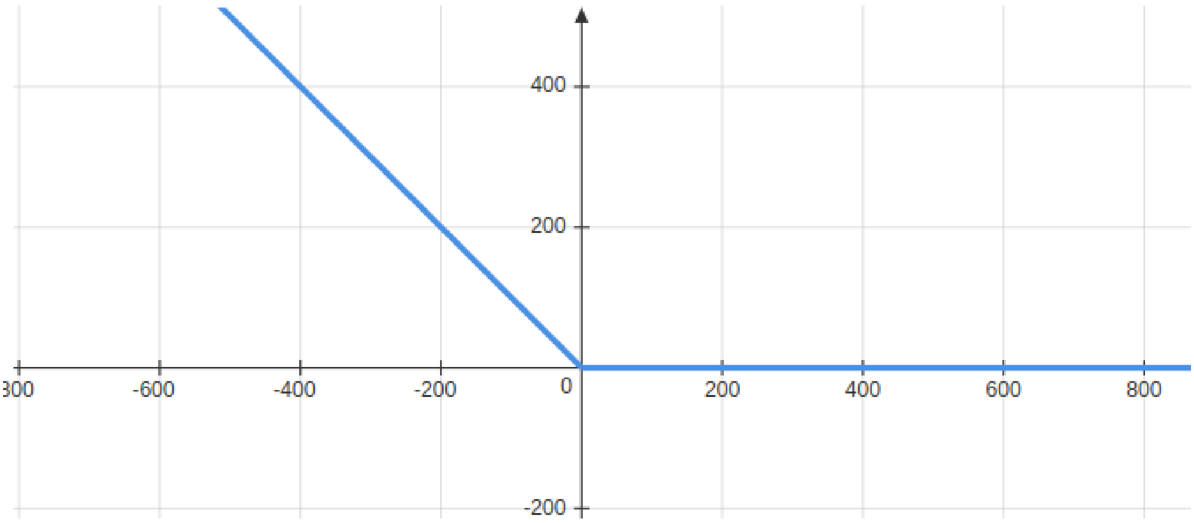
Question-6

Statement

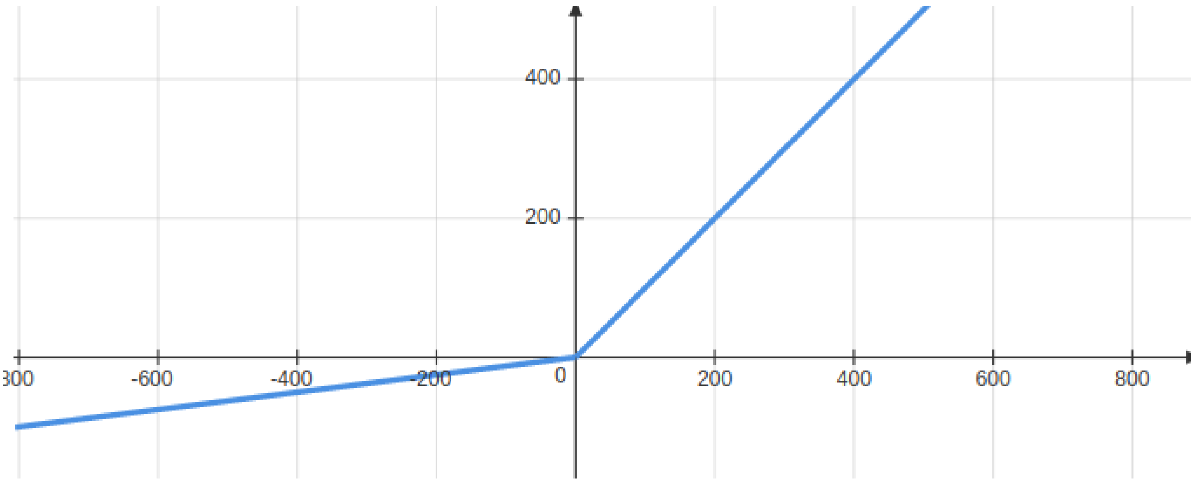
Which of the following represents ReLU activation function?

Options

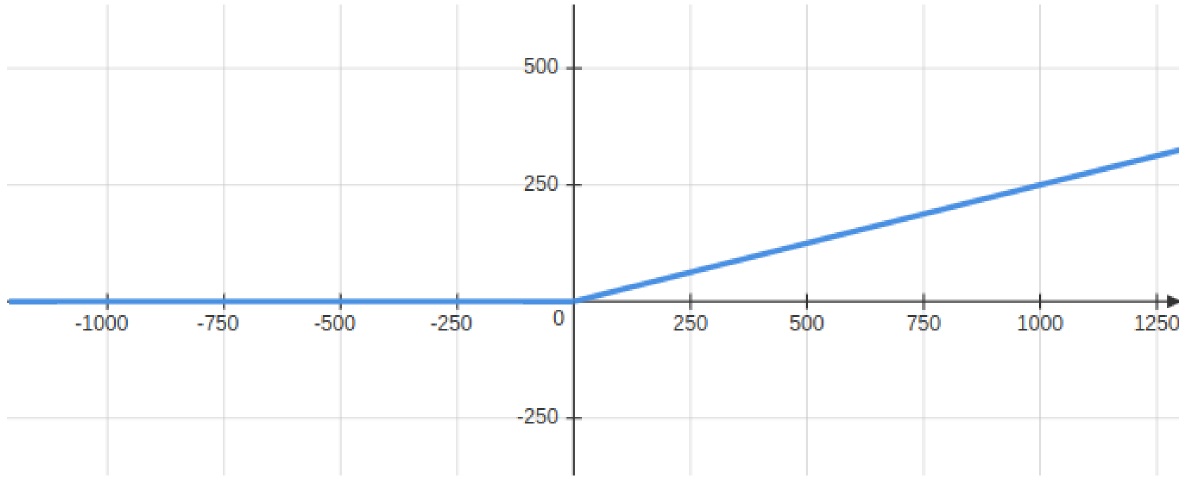
(a)



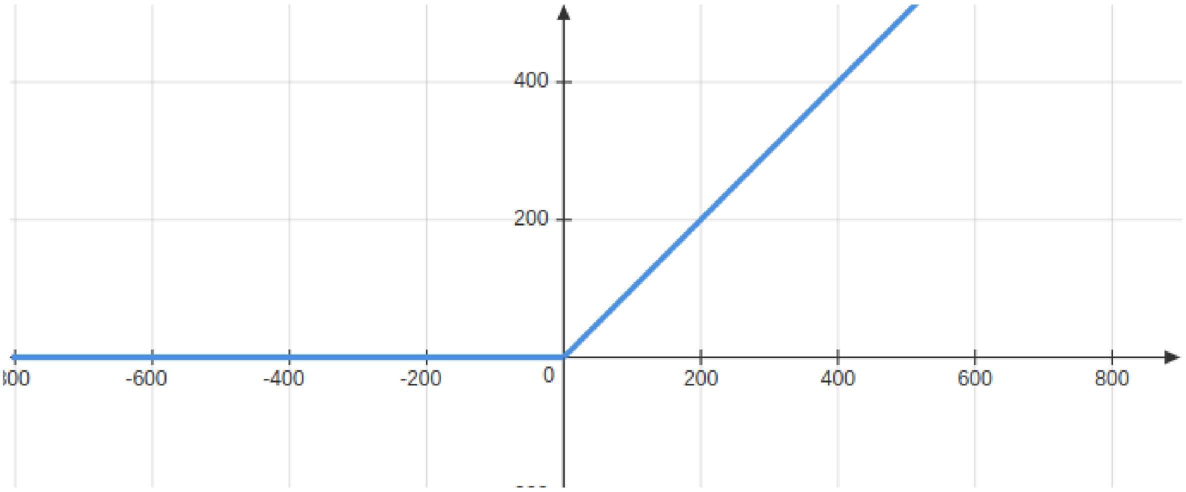
(b)



(c)



(d)



Answer

(d)

Solution

ReLU converts the negative inputs to zero, and keeps the positive inputs same.

Question-7

Statement

Suppose we build a neural network for a 5-class classification task. Suppose for a single training example, the true label is `[1 0 0 0 0]` while the predictions by the neural network are `[0.1 0.5 0.1 0.1 0.2]`. What would be the value of cross entropy loss for this example?

Answer

3. 322 (Range: 3.2 to 3.4)

Solution

Cross entropy = $-\sum y_i \, log_2 \, \hat{y}_i$

= $-1 * log_2(0.1) - 0 * log_2(0.5) - 0 * log_2(0.1) - 0 * log_2(0.1) - 0 * log_2(0.2)$

= $-log_2(0.1) = 3.322$

Question-8

Statement

State True or False:

If $CE(y_1, y_2)$ represents the value of cross entropy loss, then $CE(y_1, y_2) = CE(y_2, y_1)$ always.

Options

(a)

True

(b)

False

Answer

(b)

Solution

Cross entropy ($CE(y_1, y_2)$) = $-\sum y_1 log_2 y_2$ which is not commutative.