Quiz3

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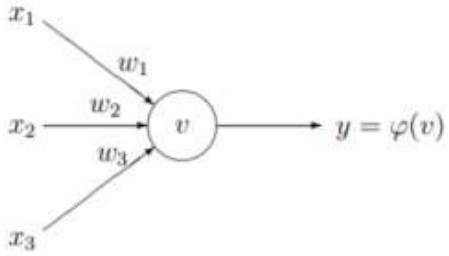
Q1 (2 marks)

Consider the figure of a neuron with inputs x1,x2,x3 with binary inputs.



Given the weights w1 = -2, w2 = 4,w3 = -3 and the activation function

$$\varphi(v) = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Given the following four input patterns 1,2,3 and 4 respectively.
(1) x1 = 1, x2 = 0, x3 = 0 ,
(2) x1 = 1, x2 = 1, x3 = 0
(3) x1 = 0, x2 = 1, x3 = 1 and
(4) x1 = 1, x2 = 1, x3 = 1

Which of the following patterns outputs y=1?

- 1, 2
- 2,3
- 2,3,4
- 2,4

Justification for Question 1

Your answer

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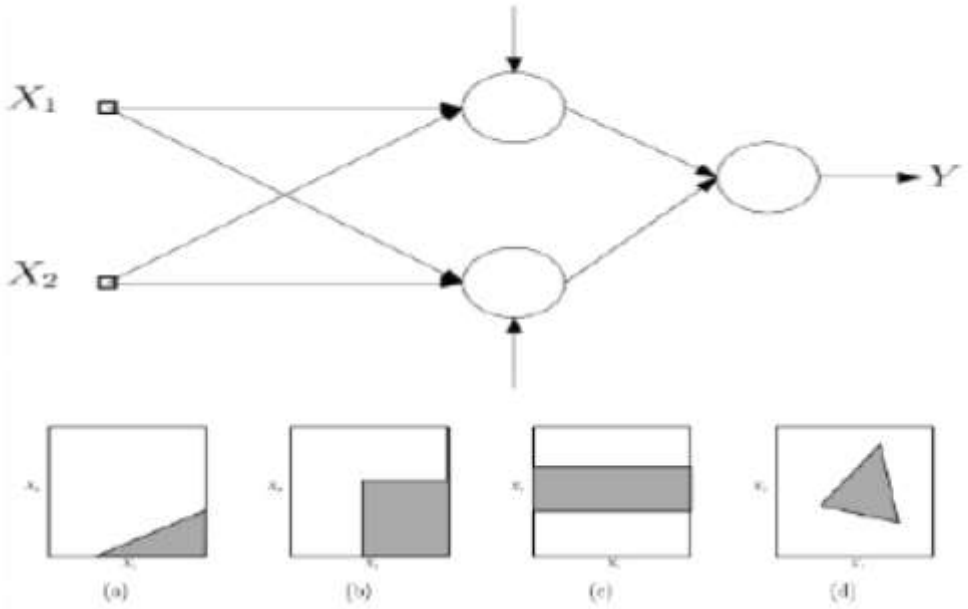
Q2. Given below is a two-layered neural network as in the figure and a set of the different classification regions, Choose the classification region(s) that couldn't be realized using the given network options: (2 marks)



- a
- b
- c
- d

Justification for Question 2

Your answer

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Q3. A 4 neuron input layer has weights given as w0 = [1,2,3,4] and bias = 0 . The Activation function is linear given by f(x) = 2x. The Input is X = [4,10,5,20], Thus the output will be: (1 marks)

Your answer

Justification for Question 3

Your answer

Q4 (2 marks)

When does the maximum and minimum of $\phi_j'(v_j(n))$ take place given,
$\phi_j'(v_j(n)) = \alpha y_j(n)[1 - y_j(n)]$
for sigmoidal activation function?

- Maximum: yj(n) = 0.0, Minimum: yj(n) =1.0
- Maximum: yj(n) = 1.0, Minimum: yj(n) = 0.0
- Maximum: yj(n) = 0.0, Minimum: yj(n) = 0.5
- Maximum: yj(n) = 0.5, Minimum: yj(n) = 0.0 or 1.0

Justification for Question 4

Your answer

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Q5. Which of the following statements are true? Check all that apply. (2 marks)

A)The activation values of hidden units in a neural network , with the the sigmoid activation function applied at every layer , are always in the range of (0,1)

B) Suppose you have a multiclass classification problem with three classes. trained , with a 3 layer network . let $a_1^{(3)} = (h\Theta(x))_1$ be the activation of the first output unit , and similarly $a_2^{(3)} = (h\Theta(x))_2$ and $a_3^{(3)} = (h\Theta(x))_3$. Then for any input x , it must be the case that $a_1^{(3)} + a_2^{(3)} + a_3^{(3)} = 1$

C) A two layer (one layer , one output layer , no hidden layer) neural network can represent the XOR function.

D) Any logical function over binary-valued (0 or 1) inputs x_1 and x_2 can be (approximately) represented using a neural network.

- [ ] A
- [ ] B
- [ ] C
- [ ] D

Justification for Question 5

Your answer

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Q6. You are training a dataset with 8 features and 5 output classes, using a deep MLP network, your model architecture is [#input, 1024, 512, 256, 64, 8 , #output] and using the sigmoid activation function on the hidden layers, the output has a softmax activation, and the loss is the cross-entropy loss. But for some reason your model is not training properly, the loss is not decreasing as you expected. You observe the inner weights of the network are quite high. Select the options which can be possible reasons : (1 marks)

- The activation function of the hidden layers is wrong as it causes the gradient approach near 0, hence inefficient weight updates.
- The activation function of the output layer is wrong, which is causing the loss to be near-constant.
- The activation function of the hidden layers is wrong as it causing the gradient approach very high values , hence inefficient weight updates.
- The activation function of the output layer is wrong, which is causing the loss to shoot up.

Justification for Question 6

Your answer

Numerical (5 marks)

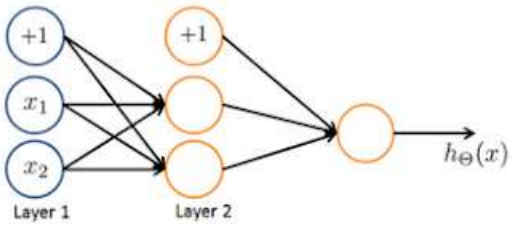
You are using the neural network pictured below and have learned the parameters

$$\Theta^{(1)} = \begin{bmatrix} 1 & -1.5 & 3.7 \\ 1 & 5.1 & 2.3 \end{bmatrix}$$

(used to compute to compute $a^{(2)}$) and $\Theta^{(2)}$=[1 , 0.6 , −0.8] (used to compute $a^{(3)}$) as a function of $a^{(2)}$. Suppose you swap the parameters for the first hidden layer between its two units so

$$\Theta^{(1)} = \begin{bmatrix} 1 & 5.1 & 2.3 \\ 1 & -1.5 & 3.7 \end{bmatrix}$$

and also swap the output layers so $\Theta^{(2)}$=[1 , −0.8 , 0.6] . How will this change the value of the output $h\Theta(x)$?



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