

1.

1 / 1 point

forward prop (coffee roasting model)

$\vec{x}$  →  $\vec{a}^{[1]}$  →  $\vec{a}^{[2]}$

$a_1^{[1]} = g(\vec{w}_1^{[1]} \cdot \vec{x} + b_1^{[1]})$   
 $a_2^{[1]} = g(\vec{w}_2^{[1]} \cdot \vec{x} + b_2^{[1]})$   
 $a_3^{[1]} = g(\vec{w}_3^{[1]} \cdot \vec{x} + b_3^{[1]})$

$w1\_1 = \text{np.array}([1, 2])$      $w1\_2 = \text{np.array}([-3, 4])$      $w1\_3 = \text{np.array}([5, -6])$   
 $b1\_1 = \text{np.array}([-1])$      $b1\_2 = \text{np.array}([1])$      $b1\_3 = \text{np.array}([2])$   
 $z1\_1 = \text{np.dot}(w1\_1, x) + b1\_1$      $z1\_2 = \text{np.dot}(w1\_2, x) + b1\_2$      $z1\_3 = ?$   
 $a1\_1 = \text{sigmoid}(z1\_1)$      $a1\_2 = \text{sigmoid}(z1\_2)$      $a1\_3 = ?$   
 $a1 = \text{np.array}([a1\_1, a1\_2, a1\_3])$

1D arrays

$a_1^{[2]} = g(\vec{w}_1^{[2]} \cdot \vec{a}^{[1]} + b_1^{[2]})$   
 $\Rightarrow w2\_1 = \text{np.array}([-7, 8, 9])$   
 $\Rightarrow b2\_1 = \text{np.array}([3])$   
 $\Rightarrow z2\_1 = \text{np.dot}(w2\_1, a1) + b2\_1$   
 $\Rightarrow a2\_1 = \text{sigmoid}(z2\_1)$

$w_1^{[2]}$      $w2\_1$

According to the lecture, how do you calculate the activation of the third neuron in the first layer using NumPy?

- ☐
- $z1\_3 = w1\_3 * x + b$

$a1\_3 = \text{sigmoid}(z1\_3)$
- ☒
- $z1\_3 = \text{np.dot}(w1\_3, x) + b1\_3$

$a1\_3 = \text{sigmoid}(z1\_3)$
- ☐
- $\text{layer\_1} = \text{Dense}(\text{units}=3, \text{activation}=\text{'sigmoid'})$

$a\_1 = \text{layer\_1}(x)$

✔ Correct

Correct. Use the numpy.dot function to take the dot product. The sigmoid function shown in lecture can be a function that you write yourself (see course 1, week 3 of this specialization), and that will be provided to you in this course.

2.

1 / 1 point

Forward prop in NumPy

$\vec{x}$  →  $\vec{a}^{[l]}$

$\vec{w}_1^{[1]} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$      $\vec{w}_2^{[1]} = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$      $\vec{w}_3^{[1]} = \begin{bmatrix} 5 \\ -6 \end{bmatrix}$

$W = \text{np.array}(\begin{bmatrix} 1 & -3 & 5 \\ 2 & 4 & -6 \end{bmatrix})$     2 by 3

$b_1^{[l]} = -1$      $b_2^{[l]} = 1$      $b_3^{[l]} = 2$

$b = \text{np.array}([-1, 1, 2])$

$\vec{a}^{[0]} = \vec{x}$

$a\_in = \text{np.array}([-2, 4])$

```
def dense(a_in, W, b, g):  
    units = W.shape[1]  
    a_out = np.zeros(units)  
    for j in range(units):  
        w = W[:, j]  
        z = np.dot(w, a_in) + b[j]  
        a_out[j] = g(z)  
    return a_out
```

According to the lecture, when coding up the numpy array W, where would you place the w parameters for each neuron?

- ☐ In the rows of W.
- ☒ In the columns of W.

✔ Correct

Correct. The w parameters of neuron 1 are in column 1. The w parameters of neuron 2 are in column 2, and so on.

3.

1 / 1 point

Forward prop in NumPy

$\vec{x}$  →  $\vec{a}^{[l]}$

$\vec{w}_1^{[1]} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$      $\vec{w}_2^{[1]} = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$      $\vec{w}_3^{[1]} = \begin{bmatrix} 5 \\ -6 \end{bmatrix}$

$W = \text{np.array}(\begin{bmatrix} 1 & -3 & 5 \\ 2 & 4 & -6 \end{bmatrix})$     2 by 3

$b_1^{[l]} = -1$      $b_2^{[l]} = 1$      $b_3^{[l]} = 2$

$b = \text{np.array}([-1, 1, 2])$

$\vec{a}^{[0]} = \vec{x}$

$a\_in = \text{np.array}([-2, 4])$

```
def dense(a_in, W, b, g):  
    units = W.shape[1]  
    a_out = np.zeros(units)  
    for j in range(units):  
        w = W[:, j]  
        z = np.dot(w, a_in) + b[j]  
        a_out[j] = g(z)  
    return a_out
```

For the code above in the "dense" function that defines a single layer of neurons, how many times does the code go through the "for loop"? Note that W has 2 rows and 3 columns.

- ☐ 5 times
- ☐ 6 times
- ☒ 3 times
- ☐ 2 times

✔ Correct

Yes! For each neuron in the layer, there is one column in the numpy array W. The for loop calculates the activation value for each neuron. So if there are 3 columns in W, there are 3 neurons in the dense layer, and therefore the for loop goes through 3 iterations (one for each neuron).