Printout

```
[[-2.03315368  0.8163886   6.67385483  7.68245252]
 [ 7.48716856  1.04731142  6.52801461 -4.33628869]
 [-1.31358836  0.65553387 -1.48526632  0.98232123]]
[[-9.6506007 ]
 [ 1.14817225]
 [13.61110443]
 [-9.62550389]]
[[0.00308167]
 [0.98943407]
 [0.98920117]
 [0.01304751]]
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QUESTION 4(a)

Neuron1

$$= sigmoid(x_1 * w_{0,1,0} + x_2 * w_{1,1,0} + x_3 * w_{2,1,0}) = \frac{1}{1 + e^{-(x_1 * w_{0,1,0} + x_2 * w_{1,1,0} + x_3 * w_{2,1,0})}}$$

$$= \frac{1}{1 + e^{-(x_1 * -2.03315368 + x_2 * 7.48716856 + x_3 * -1.31358836)}}$$

Neuron2

$$= sigmoid(x_1 * w_{0,1,1} + x_2 * w_{1,1,1} + x_3 * w_{2,1,1}) = \frac{1}{1 + e^{-(x_1 * w_{0,1,1} + x_2 * w_{1,1,1} + x_3 * w_{2,1,1})}}$$

$$= \frac{1}{1 + e^{-(x_1 * 0.8163886 + x_2 * 1.04731142 + x_3 * 0.65553387)}}$$

Neuron3

$$= sigmoid(x_1 * w_{0,1,2} + x_2 * w_{1,1,2} + x_3 * w_{2,1,2}) = \frac{1}{1 + e^{-(x_1 * w_{0,1,2} + x_2 * w_{1,1,2} + x_3 * w_{2,1,2})}}$$

$$= \frac{1}{1 + e^{-(x_1 * 6.67385483 + x_2 * 6.52801461 + x_3 * -1.48526632)}}$$

Neuron4

$$= sigmoid(x_1 * w_{0,1,3} + x_2 * w_{1,1,3} + x_3 * w_{2,1,3}) = \frac{1}{1 + e^{-(x_1 * w_{0,1,3} + x_2 * w_{1,1,3} + x_3 * w_{2,1,3})}}$$

$$= \frac{1}{1 + e^{-(x_1 * 7.68245252 + x_2 * -4.33628869 + x_3 * 0.98232123)}}$$

Output

$$= sigmoid(neuron_1 * w_{0,2,0} + neuron_2 * w_{1,2,0} + neuron_3 * w_{2,2,0} + neuron_4 * w_{3,2,0})$$

$$= \frac{1}{1 + e^{-(neuron_1 * w_{0,2,0} + neuron_2 * w_{1,2,0} + neuron_3 * w_{2,2,0} + neuron_4 * w_{3,2,0})}}$$

$$= \frac{1}{1 + e^{-(neuron_1 * -9.6506007 + neuron_2 * 1.14817225 + neuron_3 * 13.61110443 + neuron_4 * -9.62550389)}}$$

$$= \frac{1}{1 + e^{-\left(\frac{1}{1+e^{-(x_1 * -2.03315368 + x_2 * 7.48716856 + x_3 * -1.31358836)}} * -9.6506007 + \frac{1}{1+e^{-(x_1 * 0.8163886 + x_2 * 1.04731142 + x_3 * 0.65553387)}} * 1.14817225 + \frac{1}{1+e^{-(x_1 * 6.67385483 + x_2 * 6.52801461 + x_3 * -1.48526632)}} * 13.61110443 + \frac{1}{1+e^{-(x_1 * 7.68245252 + x_2 * -4.33628869 + x_3 * 0.98232123)}} * -9.62550389\right)}}$$

QUESTION 4(b)

(1) $x_1 = 0, x_2 = 0, x_3 = 1$

$$Output = \frac{1}{1 + e^{-\left(\frac{1}{1+e^{-(0 * -2.03315368 + 0 * 7.48716856 + 1 * -1.31358836)}} * -9.6506007 + \frac{1}{1+e^{-(0 * 0.8163886 + 0 * 1.04731142 + 1 * 0.65553387)}} * 1.14817225 + \frac{1}{1+e^{-(0 * 6.67385483 + 0 * 6.52801461 + 1 * -1.48526632)}} * 13.61110443 + \frac{1}{1+e^{-(0 * 7.68245252 + 0 * -4.33628869 + 1 * 0.98232123)}} * -9.62550389\right)}}$$

$$= \frac{1}{1 + e^{-(-2.044837 + 0.755792 + 2.513063 - 7.003214)}}$$

$$= 0.003082$$

(2) $x_1 = 0, x_2 = 1, x_3 = 1$

$$Output = \frac{1}{1 + e^{-\left(\frac{1}{1+e^{-(0 * -2.03315368 + 1 * 7.48716856 + 1 * -1.31358836)}} * -9.6506007 + \frac{1}{1+e^{-(0 * 0.8163886 + 1 * 1.04731142 + 1 * 0.65553387)}} * 1.14817225 + \frac{1}{1+e^{-(0 * 6.67385483 + 1 * 6.52801461 + 1 * -1.48526632)}} * 13.61110443 + \frac{1}{1+e^{-(0 * 7.68245252 + 1 * -4.33628869 + 1 * 0.98232123)}} * -9.62550389\right)}}$$

$$= \frac{1}{1 + e^{-(-9.630533 + 0.971246 + 13.523795 - 0.32501)}}$$

$$= 0.989434$$

(3) $x_1 = 1, x_2 = 0, x_3 = 1$

$$Output = \frac{1}{1 + e^{-\left(\frac{1}{1+e^{-(1 * -2.03315368 + 0 * 7.48716856 + 1 * -1.31358836)}} * -9.6506007 + \frac{1}{1+e^{-(1 * 0.8163886 + 0 * 1.04731142 + 1 * 0.65553387)}} * 1.14817225 + \frac{1}{1+e^{-(1 * 6.67385483 + 0 * 6.52801461 + 1 * -1.48526632)}} * 13.61110443 + \frac{1}{1+e^{-(1 * 7.68245252 + 0 * -4.33628869 + 1 * 0.98232123)}} * -9.62550389\right)}}$$

$$= \frac{1}{1 + e^{-(-0.32814 + 0.933865 + 13.535578 - 9.623843)}}$$

$$= 0.989201$$

(4) $x_1 = 1, x_2 = 1, x_3 = 1$

$$Output = \frac{1}{1 + e^{-\left(\frac{1}{1+e^{-(1 * -2.03315368 + 1 * 7.48716856 + 1 * -1.31358836)}} * -9.6506007 + \frac{1}{1+e^{-(1 * 0.8163886 + 1 * 1.04731142 + 1 * 0.65553387)}} * 1.14817225 + \frac{1}{1+e^{-(1 * 6.67385483 + 1 * 6.52801461 + 1 * -1.48526632)}} * 13.61110443 + \frac{1}{1+e^{-(1 * 7.68245252 + 1 * -4.33628869 + 1 * 0.98232123)}} * -9.62550389\right)}}$$

$$= \frac{1}{1 + e^{-(-9.499408 + 1.06261 + 13.610993 - 9.50022)}}$$

$$= 0.013048$$