Q4)

Result =

```
[[[6.74131162   1.96121171   1.75770435   6.25258238]
 [6.12503037   4.09658641   4.20709993  -4.23907523]
 [-2.55546758  -4.41435184  -4.27715344   2.22083898]]

[[ 12.34049255]
 [-6.46072936]
 [-6.55358903]
 [-6.40755834]]

[[0.00632205]
 [0.99535632]
 [0.991426  ]
 [0.00725331]]]
```

Q4 (a)

Neuron 1:

$$= \text{Sigmoid}(x_1 * w_{0,1,0} + x_2 * w_{1,1,0} + x_3 * w_{2,1,0})$$

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

$$= \frac{1}{1 + e^{-(x_1 * 6.74131162 + x_2 * 6.12503037 + x_3 * -2.55467518)}}$$

Neuron 2:

$$= \text{sigmoid}(x_1 * w_{0,1,1} + x_2 * w_{1,1,1} + x_3 * w_{2,1,1})$$

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

$$= \frac{1}{1 + e^{-(x_1 * 1.96121171 + x_2 * 4.09658641 + x_3 * -4.41435184)}}$$

Neuron 3:

$$= \text{sigmoid}(x_1 * w_{0,1,2} + x_2 * w_{1,1,2} + x_3 * w_{2,1,2})$$

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

$$= \frac{1}{1 + e^{-(x_1 * 1.75570435 + x_2 * 4.2070993 + x_3 * -4.77...)}}$$

Neuron 4:

$$= \text{sigmoid}(x_1 * w_{0,1,3} + x_2 * w_{1,1,3} + x_3 * w_{2,1,3})$$

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

$$= \frac{1}{1 + e^{-(x_1 * 6.25258238 + x_2 * -4.23907523 + x_3 * 2.2208)}}$$

Output:

$$= \text{sigmoid}(\text{neuron}_1 * w_{0,2,0} + \text{neuron}_2 * w_{1,2,0} + \text{neuron}_3 * w_{2,2,0} + \text{neuron}_4 * w_{3,2,0})$$

$$= \frac{1}{1 + e^{-(\text{neuron}_1 * 12.34049255 + \text{neuron}_2 * -6.46072936 + \text{neuron}_3 * -6.55358903 + \text{neuron}_4 * -6.40755...)}}$$

$$= \frac{1}{1+e^{-\left(\frac{1}{1+e^{-(x_1 * 6.74131162 + x_2 * 6.12503037 + x_3 * -2.55467518)}} * 12.34049255 + \frac{1}{1+e^{-(x_1 * 1.96121171 + x_2 * 4.09658641 + x_3 * -4.61435)}} * -6.46072936 + \frac{1}{1+e^{-(x_1 * 1.75570435 + x_2 * 4.20709993 + x_3 * -4.27}} * -6.55358903 + \frac{1}{1+e^{-(x_1 * 6.25258238 + x_2 * -4.23907523 + x_3 * 2.2208)}} * -6.40755834\right)}} \rightarrow (1)$$

Q4 (b)

1) Substituting $x_1 = 0, x_2 = 0, x_3 = 1$ in the above equation (1)

$$= \frac{1}{1 + e^{-(0.88991030667 - 0.07725532975 - 0.08973205 - 5.78029241631)}}$$

$$= \frac{1}{1 + e^{5.05736949177}}$$

$$= 0.00632205091$$

2) Substituting $x_1 = 0, x_2 = 1, x_3 = 1$ in the above equation (1)

$$= \frac{1}{1 + e^{-(5.36759395856)}}$$

$$= 0.99535632152$$

3) Substituting $x_1 = 1, x_2 = 0, x_3 = 1$ in the

equation (1)

$$= \frac{1}{1+e^{-\left(\frac{1}{1+e^{-(4.186)}} * 12.3404 + \frac{1}{1+e^{(2.453)}} * -6.4607 + \frac{1}{1+e^{(2.52444909}} * -6.55358903 + \frac{1}{1+e^{-(8.47342136)}} * -6.40755834\right)}}$$

$$= \frac{1}{1+e^{-(4.750410380 2)}}$$

$$= 0.991426000372$$

4) substituting $x_1 = 1, x_2 = 1, x_3 = 1$ in equation (1)

$$= \frac{1}{1 + e^{(4.919017995 85)}}$$

$$= 0.007253307 28$$