1. (a) i. $i_1$:

$$z = (-1 \times 0) + (-3.5 \times 1) + (1 \times 1.5) = 0 - 3.5 + 1.5 = -2$$

$$g(z) = \frac{1}{1 + e^{-(-2)}} = 0.1192$$

$i_2$:

$$z = (2.5 \times 0) + (2 \times 1) + (1 \times -0.5) = 0 + 2 - 0.5 = 1.5$$

$$g(z) = \frac{1}{1 + e^{-1.5}} = 0.8176$$

$o$:

$$z = (-1.5 \times 0.1192) + (2.5 \times 0.8176) + (1 \times 0.5) = 2.3651$$

$$g(z) = 0.9141$$

ii. $i_1$:

Prediction: $g(z) = 0.9141$
Desired output: $g^*(z) = 1.0000$
Error: 0.0859
$\Delta w_{i,j} = \alpha a_i a_j (1 - a_j) \sum w_{j,k}(T_k - O_k) O_k (1 - O_k)$
$\Delta w_{x_1,i_1} = 0.1 \times 0 \times 0.1192 \times (1 - 0.1192) \times \sum w_{i_1,o}(1.0 - 0.9141)0.9141(1 - 0.9141)$
$= 0 \times \sum w_{i_1,o} \times 0.006745$
$= 0$
$\Delta w_{x_2,i_1} = 0.1 \times 1 \times 0.1192 \times (1 - 0.1192) \times \sum w_{i_1,o} \times (0.006745)$
$= 0.1050 \times 0.006745 \times \sum w_{i_1,o}$
$= 0.0007082 \times 1.5 = 0.001062$
$\Delta w_{j,k} = \alpha a_j (T_k - O_k) O_k (1 - O_k)$
$\Delta w_{i_1,o} = 0.1 \times 0.1192 \times 0.006745 = 0.00008040$

$w_{x_1,i_1} = w_{x_1,i_1} + \Delta w_{x_1,i_1} = 2.5 + 0 = 2.5$
$w_{x_2,i_1} = w_{x_2,i_1} + \Delta w_{x_2,i_1} = 2 + 0.001062 = 2.001062$
$w_{i_1,o} = w_{i_1,o} + \Delta w_{i_1,o} = -1.5 + 0.00008040 = -1.4999196$

$i_2$:

Prediction: $g(z) = 0.9141$
Desired output: $g^*(z) = 1.0000$
Drror: 0.0859
$\Delta w_{i,j} = \alpha a_i a_j (1 - a_j) \sum w_{j,k}(T_k - O_k) O_k (1 - O_k)$
$\Delta w_{x_1,i_2} = 0.1 \times 0 \times 0.8176 \times 0.1824 \times \sum w_{i_2,o} \times 0.006745$
$= 0 \times \sum w_{i_2,o} \times 0.006745 = 0$ $\Delta w_{x_2,i_2} = 0.1 \times 1 \times 0.8176 \times 0.1824 \times \sum w_{i_2,o} \times 0.006745$
$= 0.01491 \times 0.006745 \times \sum w_{i_2,o} = 0.0001006 \times 2.5 = 0.0002515$
$\Delta w_{j,k} = \alpha a_j (T_k - O_k) O_k (1 - O_k)$
$\Delta w_{i_2,o} = 0.1 \times 0.8176 \times 0.006745 = 0.0005515$

$w_{x_1,i_1} = w_{x_1,i_2} + \Delta w_{x_1,i_2} = -1 + 0 = -1$
$w_{x_2,i_1} = w_{x_2,i_2} + \Delta w_{x_2,i_2} = -3.5 + 0.0002515 = -3.4997485$
$w_{i_2,o} = w_{i_2,o} + \Delta w_{i_2,o} = 2.5 + 0.0005515 = 2.5005515$

(b)