习题解答：

初始化网络权重和阈值：

w14 = 0.2, w15 = -0.3, w24 = 0.4, w34 = -0.5, w35 = 0.2, w46 = -0.3, w56 = -0.2，z4 = 0.4, z5 = -0.2, z6 = -0.1

进行前向传播计算输出值：

输入样本：x1 = 1, x2 = 0, x3 = 1

计算隐藏层节点输入值：

a4 = w14 * x1 + w24 * x2 + w34 * x3 - z4 = 0.2 * 1 + 0.4 * 0 + (-0.5) * 1 - 0.4 = -0.7

a5 = w15 * x1 + w35 * x3 - z5 = (-0.3) * 1 + 0.2 * 1 - (-0.2) = 0.1

计算隐藏层节点输出值：

h4 = sigmoid(a4) = 1 / (1 + exp(-a4)) = 1 / (1 + exp(-0.7)) ≈ 0.3318

h5 = sigmoid(a5) = 1 / (1 + exp(-a5)) = 1 / (1 + exp(0.1)) ≈ 0.5250

计算输出层节点输入值：

a6 = w46 * h4 + w56 * h5 - z6 = (-0.3) * 0.3318 + (-0.2) * 0.5250 - (-0.1) ≈ -0.1045

计算输出层节点输出值：

y = sigmoid(a6) = 1 / (1 + exp(-a6)) = 1 / (1 + exp(-0.1045)) ≈ 0.4739

计算输出误差：

训练样本的期望输出：t = 1

输出误差：δ6 = (t - y)*g'(a6) = 0.1311

计算隐藏层节点的误差：

δ4 = δ6 * w46 * g'(a4) = 0.1311 * (-0.3) * 0.2217 ≈ -0.008

δ5 = δ6 * w56’ * g'(a5) = 0.1311 * (-0.2) * 0.2494 ≈ -0.006

进行反向传播并更新权重：

更新输出层到隐藏层的权重：

Δw46 = η * δ6 * h4 = η * 0.1311 * 0.3318

Δw56 = η * δ6 * h5 = η * 0.1311 * 0.5250

其中，η为学习率，通常取一个较小的值，比如η = 0.1

假设η = 0.1，则

Δw46 ≈ 0.1 * 0.1311 * 0.3318 ≈ 0.004

Δw56 ≈ 0.1 * 0.1311 * 0.5250 ≈ 0.006

更新后的权重：

w46’ = w46 + Δw46 = -0.3 + 0.004 ≈ -0.294

w56’ = w56 + Δw56 = -0.2 + 0.006 ≈ -0.194

更新隐藏层到输入层的权重：

Δw14 = η * δ4 * x1 = η * (-0.006) * 1

Δw24 = η * δ4 * x2 = η * (-0.006) * 0

Δw34 = η * δ4 * x3 = η * (-0.006) * 1

Δw15 = η * δ5 * x1 = η * (-0.003) * 1

Δw25 = η * δ5 * x2 = η * (-0.006) * 0

$\Delta w35 = \eta * \delta 5 * x3 = \eta * (-0.003) * 1$

更新后的权重：

$w14' = w14 + \Delta w14 = 0.2 + (\eta * \delta 4 * x1) \approx 0.2 + (0.1 * (-0.008) * 1) = 0.1992$

$w24' = w24 + \Delta w24 = 0.4 + (\eta * \delta 4 * x2) \approx 0.4 + (0.1 * (-0.008) * 0) = 0.4$

$w34' = w34 + \Delta w34 = -0.5 + (\eta * \delta 4 * x3) \approx -0.5 + (0.1 * (-0.008) * 1) = -0.5008$

$w15' = w15 + \Delta w15 = -0.3 + (\eta * \delta 5 * x1) \approx -0.3 + (0.1 * (-0.006) * 1) = -0.3006$

$w25' = w25 + \Delta w25 = 0.1 + (\eta * \delta 5 * x2) \approx 0.1 + (0.1 * (-0.006) * 0) = 0.1$

$w35' = w35 + \Delta w35 = 0.2 + (\eta * \delta 5 * x3) \approx 0.2 + (0.1 * (-0.006) * 1) = 0.1994$