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Problem 1

(a) $\{x_1=0, x_2=1\}$

$$z_1 = 0 \times 2.5 + 1 \times 1 + 1 \times 1.5 = 2.5$$

$$g(z_1) = \frac{1}{1 + e^{-2.5}} \approx 0.9241$$

$$z_2 = 0 \times (-1.5) + 1 \times (-3) + 1 \times 2 = -1$$

$$g(z_2) = \frac{1}{1 + e^1} \approx 0.2689$$

$$z_{\hat{y}} = -1 + 0.9241 + 0.5 \times 0.2689 = 0.0586$$

$$g(\hat{y}) = \frac{1}{1 + e^{-0.0586}} \approx 0.5146$$

(b)

$$E = \frac{1}{2} (1 - 0.5146)^2 = 0.1178$$

$$\Delta w_{gb} = 0.1 \times 1 \times 0.4854 \times 0.5146 \times 0.4854 = 0.0121$$

$$\text{updated } w_{gb} = w_{gb} + \Delta w_{gb} = -0.9879$$

$$\Delta w_{gh_1} = 0.1 \times 0.9241 \times 0.4854 \times 0.5146 \times 0.4854 = 0.0112$$

$$\text{updated } w_{gh_1} = w_{gh_1} + \Delta w_{gh_1} = 1.0112$$

$$\Delta w_{gh_2} = 0.1 \times 0.2689 \times 0.4854 \times 0.5146 \times 0.4854 = 0.0033$$

$$\text{updated } w_{gh_2} = w_{gh_2} + \Delta w_{gh_2} = 0.5033$$

$$\Delta W_{h_1 b} = 0.1 \times 1 \times 0.9241 \times 0.0759 \times (1 \times 0.4854 \times 0.5146 \times 0.4854) = 0.000849$$

$$\text{updated } W_{h_1 b} = W_{h_1 b} + \Delta W_{h_1 b} = 1.500849$$

$$\Delta W_{h_1 X_1} = 0.1 \times 1 \times 0.9241 \times 0.0759 \times (1 \times 0.4854 \times 0.5146 \times 0.4854) = 0$$

$$\text{updated } W_{h_1 X_1} = W_{h_1 X_1} + \Delta W_{h_1 X_1} = 2.5$$

$$\Delta W_{h_1 X_2} = 0.1 \times 1 \times 0.9241 \times 0.0759 \times (1 \times 0.4854 \times 0.5146 \times 0.4854) = 0.000849$$

$$\text{updated } W_{h_1 X_2} = W_{h_1 X_2} + \Delta W_{h_1 X_2} = 1.000849$$

$$\Delta W_{h_2 b} = 0.1 \times 1 \times 0.2689 \times 0.7311 \times (0.5 \times 0.4854 \times 0.5146 \times 0.4854) = 0.00119$$

$$\text{updated } W_{h_2 b} = W_{h_2 b} + \Delta W_{h_2 b} = 2.00119$$

$$\Delta W_{h_2 X_1} = 0.1 \times 0 \times 0.2689 \times 0.7311 \times (0.5 \times 0.4854 \times 0.5146 \times 0.4854) = 0$$

$$\text{updated } W_{h_2 X_1} = W_{h_2 X_1} + \Delta W_{h_2 X_1} = -1.5$$

$$\Delta W_{h_2 X_2} = 0.1 \times 1 \times 0.2689 \times 0.7311 \times (0.5 \times 0.4854 \times 0.5146 \times 0.4854) = 0.00119$$

$$\text{updated } W_{h_2 X_2} = W_{h_2 X_2} + \Delta W_{h_2 X_2} = -2.99881$$