exercise 3.2 Backpropagation

(a)

$$E(w) = \frac{1}{L} \sum_{l=1}^{L} ||d_l - f(x_l; w)||_2^2$$

$$\nabla E(w) = \frac{2}{L} \sum_{l=1}^{L} (f(x_l; w) - d_l)$$

$$\frac{\partial f}{\partial w_{1,1}^{2,0}} = \sum_{j=0}^{2} w_{0,j}^{1,1} x_j$$

$$\frac{\partial E}{\partial w_{1,1}^{2,0}} = \frac{2}{L} \sum_{l=1}^{L} (f(x_l; w) - d_l) \sum_{j=0}^{2} w_{0,j}^{1,1} x_j$$

(b)

$$g(x; w) = \sum_{j=0}^{2} w_{0,j}^{1,1} x_j$$

$$\frac{\partial g}{\partial w_{0,1}^{1,1}} = x_1$$

$$\frac{\partial E}{\partial w_{0,1}^{1,1}} = \frac{2}{L} \sum_{l=1}^{L} (f(x_l; w) - d_l) \, w_{1,1}^{2,0} \, x_1$$