

1. Task 1:

$$L = (-1) \cdot \sum_{i=1}^n y_i [\log [s(w \cdot x_i)] + (1-y_i) \log [1-s(w \cdot x_i)]]$$

$$\begin{aligned} \nabla_w L &= (-1) \cdot \sum_{i=1}^n y_i \cdot x_i \cdot (1-s(w \cdot x_i)) + (1-y_i) \cancel{\log [1-s(w \cdot x_i)]} - x_i \cdot (1-s(w \cdot x_i)) \\ &= \sum_{i=1}^n y_i \cdot x_i \cdot s(w \cdot x_i) - y_i \cdot x_i + x_i \cdot s(w \cdot x_i) - x_i \cdot \cancel{s(w \cdot x_i)} \\ &= \sum_{i=1}^n x_i [s(w \cdot x_i) - y_i] \\ &= \sum_{i=1}^n x_i (h(x_i) - y_i) \end{aligned}$$

2. Task 2:

$$\textcircled{1} \quad C_{j,k} = \sum_i A_{i,j,k} b_i : 'ijk, i \rightarrow jk', [a,b]$$

$$\textcircled{2} \quad C_j = \sum_{i,k} A_{ijk} b_{ik} : 'ijk, ik \rightarrow j', [a,b]$$

$$\textcircled{3} \quad A_{ijk} = \sum_{j,l} A_{ijkl} : 'ijkl \rightarrow ik', [a]$$

$$\textcircled{4} \quad A_{ki} = \sum_{j,l} A_{ijkl} : 'ijkl \rightarrow ki', [a]$$

$$\textcircled{5} \quad C_i = \sum_{j,k} A_{ijk} \cdot d_{ijk} : 'ijk, ijk \rightarrow i', [a,a]$$

$$\textcircled{6} \quad C = x^T A X, x \in R^d, 1\text{-tensor}, A \in R^{d \times d}, 2\text{-tensor} : 'i, ij, j \rightarrow ', [a,b,c]$$

$$\textcircled{7} \quad C = A G^T B, A \in R^{d \times e}, 2\text{-tensor}, G \in R^{f \times e}, B = R^{f \times t} \\ 'ij, jl, tm \rightarrow im', [a,b,c]$$

\textcircled{8} abef

3. Task 3:

\textcircled{1} Yes. (3, 1, 5, 3) No

\textcircled{2} Yes. (3, 2, 5, 3, 4)

\textcircled{3} Yes. (3, 2, 5, 3, 4)

\textcircled{4} Yes. (3, 2, 5, 3, 2)

\textcircled{5} Yes. (3, 2, 3, 3, 2)

\textcircled{6} Atm
Yes. (7, 7)