📖 **Report.md**

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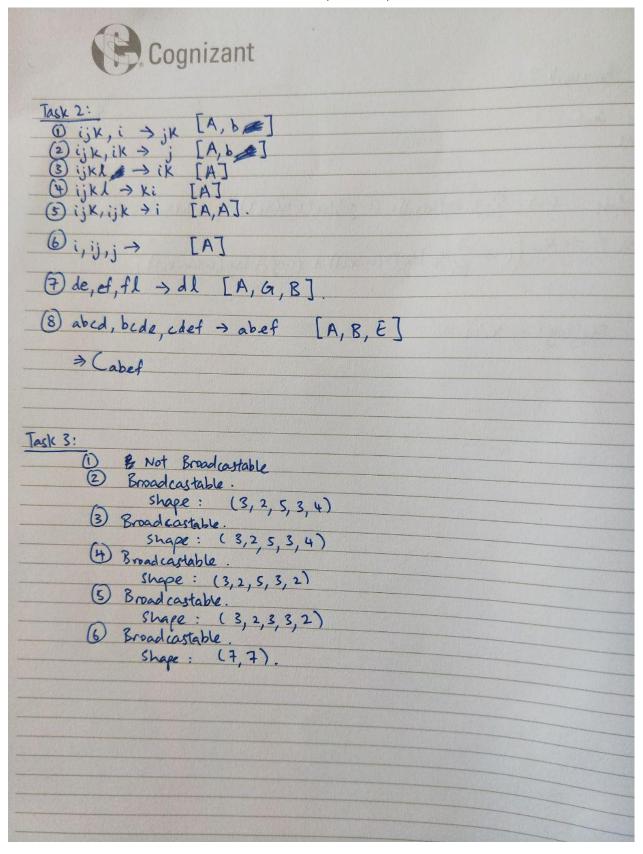StudentID: 1002075

Task 1:

Cognizant

Deep Learning homework 3.

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Task 1: $Loss = (-1) \cdot \sum_{i=1}^{n} y_i \log(h(x_i)) + (1-y_i)\log(1-h(x_i))$, $h(x_i) = s(w \cdot x_i)$.

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

$$\nabla_w \log(s(w \cdot x_i)) = \left[1 - (s(w \cdot x_i)) \right] x_i$$

$$\nabla_w \log(1 - s(w \cdot x_i)) = -(s(w \cdot x_i)) x_i$$

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

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

$$= \sum_{i=1}^{n} x_i s(w \cdot x_i) - y_i x_i$$

$$= \sum_{i=1}^{n} x_i (s(w \cdot x_i) - y_i)$$

$$= \sum_{i=1}^{n} x_i (h(x_i) - y_i) \quad * \quad (shown).$$

Task 2 and 3:

Cognizant

Task 2:
① $ijk, i \rightarrow jk$ $[A, b]$
② $ijk, ik \rightarrow j$ $[A, b]$
③ $ijkl \rightarrow ik$ $[A]$
④ $ijkl \rightarrow ki$ $[A]$
⑤ $ijk, ijk \rightarrow i$ $[A, A]$.

⑥ $i, ij, j \rightarrow$ $[A]$

⑦ $de, ef, fl \rightarrow dl$ $[A, G, B]$.

⑧ $abcd, bcde, cdef \rightarrow abef$ $[A, B, E]$

     $\Rightarrow C_{abef}$

Task 3:
① ~~E~~ Not Broadcastable
② Broadcastable.
     shape : $(3, 2, 5, 3, 4)$
③ Broadcastable.
     shape : $(3, 2, 5, 3, 4)$
④ Broadcastable.
     shape : $(3, 2, 5, 3, 2)$
⑤ Broadcastable.
     shape : $(3, 2, 3, 3, 2)$
⑥ Broadcastable.
     shape : $(7, 7)$.