

P1

a)

b)

$$f = \frac{1}{1+e^{-x}}$$

$$f' = -\frac{1}{(1+e^{-x})^2} (1+e^{-x})'$$

$$= \frac{e^{-x}}{(1+e^{-x})^2}$$

$$(1-f)f = \left(1 - \frac{1}{1+e^{-x}}\right) \left(\frac{1}{1+e^{-x}}\right) = \frac{e^{-x}}{1+e^{-x}} \cdot \frac{1}{1+e^{-x}} = f'$$

$$\therefore f' = (1-f)f$$

no min and max
 $\lim_{x \rightarrow -\infty} f(x) = 0$, $\lim_{x \rightarrow \infty} f(x) = 1$

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P2 a) $P(B=0) = 0.2 + 0.6 = 0.8$

b) $P(A=1|B=0) = \frac{0.6}{0.8} = \frac{3}{4}$

c) $P(A=B) = 0.2$

P3 c)

P4 $M \cdot v = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 0 \\ 1 & 3 & 3 \end{bmatrix} \begin{bmatrix} 3 \\ 0 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 \times 3 + 2 \times 0 + 3 \times 2 \\ 2 \times 3 + 3 \times 0 + 0 \times 2 \\ 1 \times 3 + 3 \times 0 + 3 \times 2 \end{bmatrix} = \begin{bmatrix} 9 \\ 6 \\ 9 \end{bmatrix}$

$$v^T M = [3 \ 0 \ 2] \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 0 \\ 1 & 3 & 3 \end{bmatrix} = [3 \times 1 + 0 \times 2 + 2 \times 3, 3 \times 2 + 0 \times 3 + 2 \times 3, 3 \times 3 + 0 \times 0 + 2 \times 3] = [5, 12, 15]$$

$$v^T v = [3, 0, 2] \begin{bmatrix} 3 \\ 0 \\ 2 \end{bmatrix} = 3^2 + 2^2 = 13$$

Survey

a) python

b) python, R

c) reinforcement learning
 LSTM