

HW3

Q 1/1:-

$$E(w) = - \sum_n \{ t_n \ln(y_n) + (1-t_n) \ln(1-y_n) \}$$

$$y = y_k - t_k$$

$$y_k = \frac{1}{1+e^{-a}}$$

$$\text{now } \frac{dE(w)}{da_k} = \frac{dE}{dy} \cdot \frac{dy}{da_k}$$

$$1) \frac{dE}{dy} \Rightarrow \left[ -\frac{t_n}{y_n} + \frac{(1-t_n)}{1-y_n} \right] dy$$

$$2) \frac{dy}{da_k} \Rightarrow \frac{e^a}{(1+e^a)^2}$$

$$\text{now } \frac{dE}{dy} \cdot \frac{dy}{da_k} = \frac{1-t_n}{1-y_n} \cdot \frac{e^a}{(1+e^a)^2} - \frac{t_n}{y_n}$$

$$= \frac{1-t_n}{1-\left(\frac{1}{1+e^a}\right)} \cdot \frac{e^a}{(1+e^a)^2} - \frac{t_n}{\frac{1}{1+e^a}} \cdot \frac{e^a}{(1+e^a)^2}$$

$$= \frac{1-t_n}{\frac{1+e^a}{1+e^a}} \cdot \frac{e^a}{(1+e^a)^2} - \frac{t_n}{\frac{e^a}{e^a+1}} \cdot \frac{e^a}{(1+e^a)^2}$$

$$= \frac{1-t_n}{1+e^a} \cdot \frac{e^a}{(1+e^a)^2} - \frac{t_n}{1+e^a}$$

$$= \frac{(1-t_n)e^a}{1+e^a} - \frac{t_n}{1+e^a} \Rightarrow \frac{e^a - t_n e^a - t_n}{1+e^a}$$

$$\Rightarrow \frac{-t_n(e^a+1)}{1+e^a} + \frac{e^a}{1+e^a} \Rightarrow \frac{e^a}{1+e^a} - t_n \Rightarrow y_k - t_k$$

$$\boxed{y_k - t_k}$$