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Question :-

(a)

hypothesis function, $h_\theta(x) = g(\theta^T x)$

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

cost function, $J(\theta) =$

$$-\frac{1}{m}\left[\sum_{i=1}^{m} y_i \cdot \log(h_\theta(x_i)) + (1-y_i)\cdot \log(1-h_\theta(x_i))\right]$$

for

$$y = f(x) = \theta^T x$$

$$= \begin{bmatrix} \theta_0 & \theta_1 & \theta_2 & \cdots & \theta_n \end{bmatrix} \begin{bmatrix} x_0 \\ x_1 \\ \vdots \\ x_n \end{bmatrix}$$

Sigmoid function, $f(z) = \frac{1}{1+e^{-z}}$

$$\therefore f(\theta^T z) = \frac{1}{1+e^{-\theta^T z}}$$

for logistic ~~reg~~ regression,

$y=0$ or $y=1$

if $y_i=0$ then, $y_i \cdot \log(h_\theta(x_i))=0$

else, $y_i=\cancel{0}1$ then, $(1-y_i)\cdot\log(1-h_\theta(x_i))=0$

from the ~~probabili~~ probability function,

we can say,

cost function ~~of~~ $J(\theta)$ =

$$\frac{1}{m}\left[\sum_{i=1}^{m} y_i \cdot \log(h_\theta(x_i)) + (1-y_i)\cdot\log(1-h_\theta(x_i))\right]$$

(b) for, $\theta=[0, 0.1, 0.008, 0.001]$

As, $\theta[0]$ = bias

$$\begin{bmatrix}0.1 & 0.008 & 0.001\end{bmatrix}\begin{bmatrix}10 & 124 & -137\\ 5 & 398 & -112\\ 3 & 312 & -172\end{bmatrix} = \begin{bmatrix}1.85\\ 3.572\\ 2.624\end{bmatrix}$$

adding bias = $\theta[0]$, the result is same

$$\therefore h_\theta^1(x) = \begin{bmatrix} \frac{1}{1+e^{-1.85}} \\ \frac{1}{1+e^{-3.572}} \\ \frac{1}{1+e^{-2.62}} \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

Again for, $\theta = [0 \quad 0.5 \quad 0.008 \quad 0.002]$

$$[0.5 \quad 0.008 \quad 0.002] \begin{bmatrix} 10 & 124 & -139 \\ 5 & 398 & -112 \\ 3 & 312 & -172 \end{bmatrix} = \begin{bmatrix} 5.714 \\ 5.46 \\ 3.652 \end{bmatrix}$$

adding bias = $\theta[0]$, the result remain same,

$$h_\theta^2(x) = \begin{bmatrix} \frac{1}{1+e^{-5.714}} \\ \frac{1}{1+e^{-5.46}} \\ \frac{1}{1+e^{-3.652}} \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

for both $h_\theta^1(x)$ and $h_\theta^2(x)$

The accuracy = 33·33%

So, both the parameter will show same result.