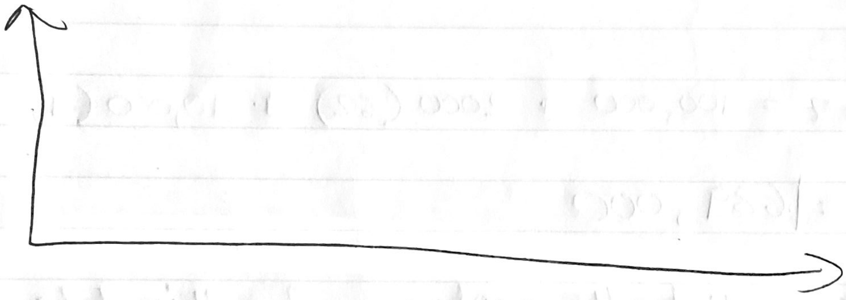
Password = 3554

Name: Imran Warfa ID: 500899229

1. 235 total

25 – A
20 – B } 45
190 – C



6. Deciding how much mortgage to be given
↳ Linear Regression

a. I believe the correct model is linear Regression because we are dealing with a Regression Problem & not a classification problem

b.

Walk-Score	# of bedrooms	Annual Income	y

$$\therefore z = w_0 \cdot \cancel{x_0}^{1} + w_1 x_1 + w_2 x_2 + w_3 x_3$$

$$= w_0 + w_1 x_1 + w_2 x_2 + w_3 x_3$$

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↳ x4

⑤ $z = w_0 + w_1 x_1 + w_2 x_2 + w_3 x_3$

$w_0 = \$100,000$
$w_1 = \$2000$
$w_2 = \$10000$
$w_3 = \$(x4 + 0.5)$
$= \$(8 + 0.5) = \$8.5$

$\hat{y} = z = 100,000 + 2000(62) + 10,000(4) + 8.5(50,000)$

$= \$689,000$

∴ I predict the mortgage for this data to be $689,000

7. $\log_e(\text{odds}) = -25.8 + 0.5 \cdot \dfrac{\text{White Blood Cell Count}}{1000}$

ⓐ $P(\text{Coronavirus}) = 0.8$

$0.8 = \dfrac{1}{1+e^{-z}}$

$0.8 + 0.8e^{-z} = 1$
$0.8e^{-z} = 0.2$
$e^{-z} = 0.25$
$\ln(e^{-z}) = \ln(0.25)$
$-z = \ln(0.25)$
$z = -\ln(0.25) = 1.38629$

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wc = white blood cell count

$$\left[z = -25.8 + 0.5 \cdot \frac{wc}{1000} \right] 1000$$

$$1000z = -25{,}800 + 0.5\,wc$$

$$wc = \frac{1000z + 25{,}800}{0.5}$$

$wc = 54{,}372.58$ or $\underline{\underline{54{,}373}}$ white blood cells

b. Elf $P > 60\%$ (Class 1)

① $z = -25.8 + 0.5 \cdot \frac{(20{,}800)}{1000} = -15.4$

$$P_1 = \frac{1}{1 + e^{-(-15.4)}} = 2.05 \cdot 10^{-7}$$

② $z = -25.8 + 0.5 \cdot \frac{(17{,}600)}{1000} = -17$

$$P_2 = \frac{1}{1 + e^{-(-17)}} = 4.14 \cdot 10^{-8}$$

③ $z = -25.8 + 0.5 \cdot \frac{(35{,}200)}{1000} = -8.2$

$$P_3 = \frac{1}{1 + e^{-(-8.2)}} = 2.745 \cdot 10^{-4}$$

④ $z = -25.8 + 0.5 \cdot \frac{(30{,}100)}{1000} = -10.75$

$$P_4 = \frac{1}{1 + e^{-(-10.75)}} = 2.144 \cdot 10^{-5}$$

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⑤ $z = -25.8 + 0.5 \cdot \frac{53,800}{1000} = 1.1$

$$P_5 = \frac{1}{1+e^{-1.1}} = 0.75$$

$P > 60\% = \text{Positive}$

WC	y	$\hat{y}$
20,800	0	0
17,600	0	0
35,200	1	0
30,100	1	0
53,800	1	1

Accuracy is $= 1/5 = 20\%$

(17,600)
$P_i = 4.14 \cdot 10^{-8}$

c) $\text{LogLoss} = -\left[\cancel{y_i}^{\,0} \ln(P_i) + (1-y_i)\ln(1-P_i)\right]$

$= -\left[(1-0)\ln\left(1-(4.14 \cdot 10^{-8})\right)\right]$

$= 4.14 \cdot 10^{-8}$

3\. a) $w_0 = 5$, $w_1 = 3.5$, $\lambda = 0.01$, $\alpha = 0.01$

$h_w(x) = \text{Round}\left(\sum_{j=0}^{n} w_j \cdot x_j\right)$

Assuming this is the data:

1st Quarter	Total Score
27	104
36	123

$h_w(x) = \text{Round}(5 + 3.5 \cdot 27) = 100$

$h_w(x) = \text{Round}(5 + 3.5 \cdot 36) = 131$

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$$\text{Error} = J(w) = \frac{1}{2(2)}\left[(104-100)^2 + (123-131)^2\right] + \frac{0.01}{2}\left[(5)^2 + (3.5)^2\right]$$

$$J(w) = \frac{1}{4}\left[(16) + (64)\right] + (5\times10^{-3})\left[25 + 12.25\right]$$

$$J(w) = 20 + 0.18625 = \underline{\underline{20.18625}}$$

b) $$w_{k\,new} = w_{k\,old} - \alpha\cdot\Big(\frac{1}{m}\sum_{i=1}^{m} x_k^{(i)}\cdot\big(y^{(i)} - \overbrace{\textstyle\sum_{j=0}^{n} w_{k\,old}\cdot x_j^{(i)}}^{\text{hypothesis}}\big)\Big) - \alpha\left[\lambda\cdot w_{k\,old}\right]$$

$$w_{0\,new} = w_{0\,old} - \alpha\cdot\Big(\frac{1}{m}\sum_{i=1}^{m} x_0^{(i)}\cdot\big(y^{(i)} - \textstyle\sum_{j=0}^{n} w_{0\,old_j}\cdot x_j^{(i)}\big)\Big) - \alpha\left[\lambda\cdot w_{0\,old}\right]$$

Note: I believe there should be a j subscript here

↳ I will assume this was a mistake

$$w_{0\,new} = 5 - (0.01)\cdot\Big(\frac{1}{2}\left[(1)\cdot(104-100) + (1)(123-131)\right]\Big) - (0.01)\left[0.01\cdot 5\right]$$

$$w_{0\,new} = 5 - \frac{0.01}{2}\left[4 - 8\right] - (5\cdot10^{-4}) = 5.0195$$

$$w_{1\,new} = 3.5 - \frac{0.01}{2}\left[(27)(104-100) + (36)(123-131)\right] - 0.01\left[0.01\cdot 3.5\right]$$

$$= 3.5 - \frac{0.01}{2}\left[108 - 288\right] - 3.5\cdot10^{-4}$$

$$= 3.5 + \frac{0.01}{2}(180) - 3.5\cdot10^{-4}$$

$$w_{1\,new} = 4.39965$$

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weights	Initialization	New weights
w_0	5	5.0195
w_1	3.5	4.39965

These are the new updated weights after 1 epoch

c) $J(w) = \frac{1}{2m} \sum_{i=1}^{m} \left(y^{(i)} - \sum_{i=0}^{n} w_j \cdot x_j^{(i)}\right)^2 + \frac{\lambda}{2} \sum_{j=1}^{n} w_j^2$

$h_w(x) = \text{Round}(5.0195 + 4.39965 \cdot 27) = \text{Round}(123.8) = 124$

$h_w(x) = \text{Round}(5.0195 + 4.39965 \cdot 36) = \text{Round}(163.4) = 163$

$J = \frac{1}{2(2)}\left[(104-124)^2 + (123-163)^2\right] + \frac{0.01}{2}\left[(5.0195)^2 + (4.39965)^2\right]$

$= \frac{1}{4}\left[2000\right] + \frac{0.01}{2}\left[44.55\right]$

$J = \text{Error} = \underline{500.22}$

The error has increased from initial cost.

d) $h_w(40) = \text{Round}(5.0195 + 4.39965 \cdot 40)$

$= \underline{181}$

∴ I predict Raptors to score 181 points if they score 40 in the 1st Quarter using these updated weights