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$w_1 = 0.8$

$w_2 = 0.4$

$b = -4.0$

1. Compute Probabilities $z = w_1 x_1 + w_2 x_2 + b$ then $\hat{y} = \sigma(z)$

Customer A $(x_1 = 1, x_2 = 4, y = 0)$

$z = 0.8(1) + 0.4(4) + (-4.0) = \boxed{-1.6}$

$\hat{y} = \frac{1}{1 + e^{-(-1.6)}} = \boxed{0.168}$

Customer B $(x_1 = 2, x_2 = 3, y = 0)$

$z = 0.8(2) + 0.4(3) + (-4.0) = \boxed{-1.2}$

$\hat{y} = \frac{1}{1 + e^{-(-1.2)}} = \boxed{0.231}$

Customer C $(x_1 = 3, x_2 = 7, y = 1)$

$z = 0.8(3) + 0.4(7) + (-4.0) = \boxed{1.2}$

$\hat{y} = \frac{1}{1 + e^{-1.2}} = \boxed{0.769}$

Customer D $(x_1 = 5, x_2 = 2, y = 1)$

$z = 0.8(5) + 0.4(2) + (-4.0) = \boxed{0.8}$

$\hat{y} = \frac{1}{1 + e^{-0.8}} = \boxed{0.690}$

Customer E $(x_1 = 6, x_2 = 6, y = 1)$

$z = 0.8(6) + 0.4(6) + (-4.0) = \boxed{3.2}$

$\hat{y} = \frac{1}{1 + e^{-3.2}} = \boxed{0.961}$

Customer	Time on site (x_1)	Pages viewed (x_2)	Purchase (y)	$\hat{y}$
A	1	4	0	0.168
B	2	3	0	0.231
C	3	7	1	0.769
D	5	2	1	0.690
E	6	6	1	0.961

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2. Compute Average loss

Customer A $(y=0, \hat{y}=0.168)$

$loss_A = -(0 \times \ln(0.168) + (1-0) \times \ln(1-0.168))$

$= -(0 + \ln(0.832))$

$= -(0.184)$

$= \boxed{0.184}$

Customer B $(y=0, \hat{y}=0.231)$

$loss_B = -(0 \times \ln(0.231) + (1-0) \times \ln(1-0.231))$

$= -(0 + \ln(0.769))$

$= -(-0.262)$

$= \boxed{0.262}$

Customer C $(y=1, \hat{y}=0.769)$

$loss_C = -(1 \times \ln(0.769) + (1-1) \times \ln(1-0.769))$

$= -(\ln(0.769) + 0)$

$= -(-0.262)$

$= \boxed{0.262}$

Customer D $(y=1, \hat{y}=0.690)$

$loss_D = -(1 \times \ln(0.690) + (1-1) \times \ln(1-0.690))$

$= -(\ln(0.690) + 0)$

$= -(-0.371)$

$= \boxed{0.371}$

Customer E $(y=1, \hat{y}=0.961)$

$loss_E = -(1 \times \ln(0.961) + (1-1) \times \ln(1-0.961))$

$= -(\ln(0.961) + 0)$

$= -(-0.039)$

$= \boxed{0.039}$

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Customer	Time on site (x_1)	Pages viewed (x_2)	(y)	$\hat{y}$	Loss
A	1	4	0	0.168	0.184
B	2	3	0	0.231	0.262
C	3	7	1	0.769	0.262
D	5	2	1	0.690	0.371
E	6	6	1	0.961	0.039

Average Loss = $\frac{0.184 + 0.262 + 0.262 + 0.371 + 0.039}{5} = \boxed{0.2236}$

3. Update the slope and intercept using Gradient Descent

learning rate $n = 0.1$

Compute $(\hat{y}_i - y_i)$ for each customer

A: $0.168 - 0 = \boxed{0.168}$

B: $0.231 - 0 = \boxed{0.231}$

C: $0.769 - 1 = \boxed{-0.231}$

D: $0.690 - 1 = \boxed{-0.310}$

E: $0.961 - 1 = \boxed{-0.039}$

Compute Gradients

$\frac{\partial L}{\partial w_1} = \frac{1}{5}((0.168 \times 1) + (0.231 \times 2) + (-0.231 \times 3) + (-0.310 \times 5) + (-0.039 \times 6))$

$= \frac{1}{5}(0.168 + 0.462 - 0.693 - 1.550 - 0.234)$

$= \frac{1}{5}(-1.847)$

$= \boxed{-0.3694}$

$\frac{\partial L}{\partial w_2} = \frac{1}{5}((0.168 \times 4) + (0.231 \times 3) + (-0.231 \times 7) + (-0.310 \times 2) + (-0.039 \times 6))$

$= \frac{1}{5}(0.672 + 0.693 - 1.617 - 0.620 - 0.234)$

$= \frac{1}{5}(-1.106)$

$= \boxed{-0.2212}$

$\frac{\partial L}{\partial b} = \frac{1}{5}(0.168 + 0.231 - 0.231 - 310 - 0.039)$

$= \frac{1}{5}(-0.181)$

$= \boxed{-0.0362}$

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Update Parameters ($\eta = 0.1$)

new m_1 = $0.8 - 0.1 \times (-0.3694)$
$= 0.8 + 0.03694$
$= \boxed{0.83694}$

new m_2 = $0.4 - 0.1 \times (-0.2212)$
$= 0.4 + 0.02212$
$= \boxed{0.42212}$

new b = $-4.0 - 0.1 \times (-0.0362)$
$= -4.0 + 0.00362$
$= \boxed{-3.99638}$

- new m_1 = 0.83694
- new m_2 = 0.42212
- new b = 3.99638

4. Compute new probabilities using the new slopes and intercept

Customer A ($x_1 = 1$, $x_2 = 4$)

$z = 0.83694(1) + 0.42212(4) + (-3.99638)$
$= \boxed{-1.47096}$

$\hat{y} = \frac{1}{1 + e^{-(-1.47096)}}$
$= \boxed{0.187}$

Customer B ($x_1 = 2$, $x_2 = 3$)

$z = 0.83694(2) + 0.42212(3) + (-3.99638)$
$= \boxed{-1.05614}$

$\hat{y} = \frac{1}{1 + e^{-(-1.05614)}}$
$= \boxed{0.258}$

Customer C ($x_1 = 3$, $x_2 = 7$)

$z = 0.83694(3) + 0.42212(7) + (-3.99638)$
$= \boxed{1.46928}$

$\hat{y} = \frac{1}{1 + e^{-1.46928}}$
$= \boxed{0.813}$

Customer D ($x_1 = 5$, $x_2 = 2$)

$z = 0.83694(5) + 0.42212(2) + (-3.99638)$
$= \boxed{1.03256}$

$\hat{y} = \frac{1}{1 + e^{-1.03256}}$
$= \boxed{0.737}$

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Customer E ($x_1 = 6$, $x_2 = 6$)

$z = 0.83694(6) + 0.42212(6) + (-3.99638)$

$= \boxed{3.55798}$

$\hat{y} = \frac{1}{1+e^{-3.55798}}$

$= \boxed{0.972}$

New predicted probabilities

Customer	x_1	x_2	Y	new $\hat{y}$
A	1	4	0	0.187
B	2	3	0	0.258
C	3	7	1	0.813
D	5	2	1	0.737
E	6	6	1	0.972

5. Compute new Average Loss

Customer A ($y = 0$, $\hat{y} = 0.187$)

$loss_A = -(0 \times \ln(0.187) + (1-0) \times \ln(1-0.187))$

$= -\ln(0.813) \Rightarrow -(-0.207)$

$= \boxed{0.207}$

Customer B ($y = 0$, $\hat{y} = 0.258$)

$loss_B = -(0 \times \ln(0.258) + (1-0) \times \ln(1-0.258))$

$= -\ln(0.742) \Rightarrow -(-0.298)$

$= \boxed{0.298}$

Customer C ($y = 1$, $\hat{y} = 0.813$)

$loss_C = -(1 \times \ln(0.813) + (1-1) \times \ln(1-0.813))$

$= -\ln(0.813) \Rightarrow -(-0.207)$

$= \boxed{0.207}$

Customer D ($y = 1$, $\hat{y} = 0.737$)

$loss_D = -(1 \times \ln(0.737) + (1-1) \times \ln(1-0.737))$

$= -\ln(0.737) \Rightarrow -(-0.305)$

$= \boxed{0.305}$

Customer E ($y = 1$, $\hat{y} = 0.972$)

$loss_E = -(1 \times \ln(0.972) + (1-1) \times \ln(1-0.972)) \Rightarrow -\ln(0.972)$

$= -(-0.028)$

$= \boxed{0.028}$

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$$\text{NewLoss}_{avg} = \frac{0.207 + 0.298 + 0.207 + 0.305 + 0.028}{5} = \boxed{0.209}$$

Customer	X_1	X_2	Y	$\hat{y}$	new loss
A	1	4	0	0.187	0.207
B	2	3	0	0.258	0.298
C	3	7	1	0.813	0.207
D	5	2	1	0.737	0.305
E	6	6	1	0.972	0.028
					0.209